The Monthly Review

Published by the AMERICAN ELECTRO-PLATERS' SOCIETY

MARCH 1937

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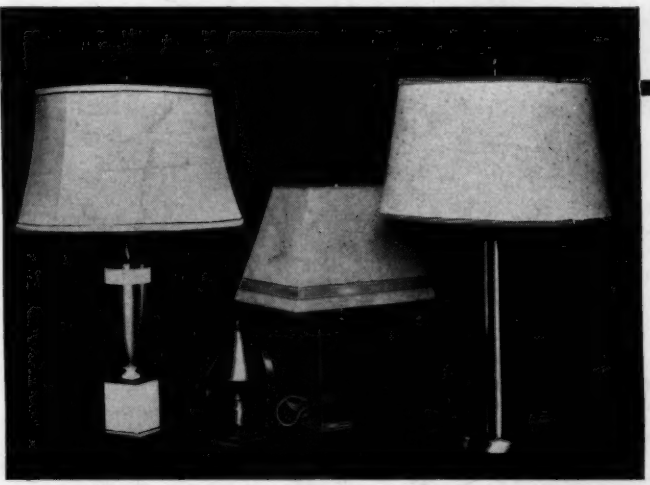

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Published by the AMERICAN ELECTRO-PLATERS' SOCIETY

A Society for the Advancement of the Science of Electro-Plating

MARCH 1937

Hogaboom **— Open House**	**153**
Soderberg **— Drag-Out**	**156**
Smith **— Anodic Treatment of Aluminum**	**175**
Mr. T. C. Eichstaedt	**182**
Waite **— The Effect of Nickel Chloride in Nickel Plating Solutions**	**183**
Sizelove **— Bright Nickel Plating**	**193**
Blake **— Solvent Degreasing Prior to Electroplating**	**199**
Intelligence Test	**202**
Here and There	**203**
The Abstract Section	**205**
Branch News	**208**
Membership Report	**230**
Buyer's Guide	**238**
Branch Directory	**239**

SUBSCRIPTION $3.00 A YEAR

Entered as second class matter at the Post Office at Springfield, Mass., September 8, 1930, under Act of August 24, 1912.

Acceptance for mailing at special rate of postage, provided for in section 1103, Act of February 28, 1925, authorized September 3, 1926

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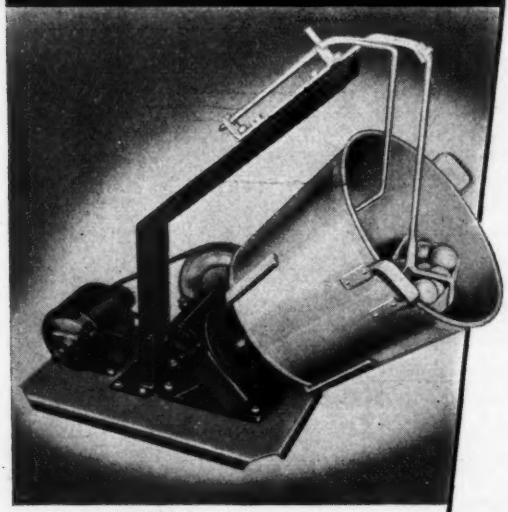

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The Monthly Review

Published by the
AMERICAN ELECTRO-PLATERS' SOCIETY

Publication and Editorial Office
90 Maynard St.
Springfield, Massachusetts

VOL. XXIV MARCH 1937 NO. 3

Open House

By GEORGE B. HOGABOOM

The members of the A.E.S. have been most fortunate in their relations with the "technical" man. He not only has given freely of his knowledge but, so as to become more closely associated and therefore of more help, has become a member of the A.E.S. even though he was denied all "active" participation in Branches and the privilege of being a member of the National society. Of course, he wished to increase his knowledge of plating but what he gave was far greater than what he received. He has assisted in forming classes to teach "practical" men how to control their solutions — how to really understand their work. He has contributed papers and discussions on phases of electroplating that added materially to the platers' knowledge and which often assisted in solving perplexing problems and so often helped the plater to hold down his job.

The fear has been that the "technical" man was after the plater's job. Many of you have attended the annual meeting of the Branches and the Annual convention of the National Society. Whom did you meet at these meetings? The very same "practical" men who have attended these meetings for the past 25 years and they are still holding down their jobs, and this is regardless of the great advances made in the science of electroplating during that time.

At these conventions and in the monthly REVIEW, who contributed to the success of the program without which there would be no A.E.S. as it is today. Who contributed the articles that

have been published in the monthly REVIEW during these 25 years? Well, you ask, what of it? Just this. Suppose all the technically trained men were to resign from the A.E.S. to form an organization of their own, or become affiliated with another organization and refuse to contribute to the A.E.S. meetings? How long would the present influence and prestige of the A.E.S. last? Not more than two conventions. The educational sessions, the main attraction of the convention, would be a flop. Electroplating is advancing in strides. More and better knowledge of processes and solutions are demanded. What chance has the "practical" man to keep abreast with this progress? What can he contribute? In view of what he has done, very little, alone, he needs technical assistance.

There was a time, and it seems only a few days ago, when poor work had to be accepted — just because! "Try" methods were the only ones known to correct the contrary solution, and "old timers" you readily recall how they made you sweat and lose sleep. While all plating troubles have not been eliminated it is true that with improved cleaning methods and the analytical control of the solutions that the rejections due directly to plating have been reduced to a very low point. What brought this improvement about? Was it the "practical" man who for years had struggled vainly with his problems, or was it the assistance of the "technical" man through working out simple methods of chemical control that could be easily understood.

It is seldom that assistance of such importance is offered an organization like the American Electro-Platers' Society. While the society has a unique standing in the vocational field due to the firm adherence to its object — education of its members — it must be recognized that the future education and advancement depends entirely upon technical men who are now without power to assist in directing the aims of the society. The so-called "practical" man and the "technical" man should be one, as at no time in the history of the A.E.S. is it more important that one should

be for all and all for one. There should be one class of membership. All active. All striving for the one object — advancement in the science of electroplating. This can be accomplished only by equals working shoulder to shoulder.

Let us be frank and lay aside strictly personal opinions and admit who is the real "practical" man. Is he the man at the tanks that looks in bewilderment into the plating solution and vainly tries to reason out why it does not obey his commands and stop being so damnably arbitrary, or is he the man who is master of the solution and who can make it produce good work consistently? Ask your boss! Then be consistent. You permit anyone interested in electroplating to attend the meetings of your annual conventions. The transactions containing both the papers and the discussion can be purchased by anyone. You accept all that those interested in electroplating give you to make your meetings and conventions a success, then why not be fair and just and recognize your obligations to those who have contributed so much to the advancement of the society and to the advancement of your knowledge so that you have become better platers.

Electroplating is no longer an art confined to individual plating rooms or to any single group of platers. Those who contributed to the "advancement of the knowledge of electroplating" -- the A.E.S. slogan, at the International Conference on Electroplating in London, England, came from all parts of the world. This first international conference should have been sponsored by the A.E.S. Our hats off to our English brothers for showing us the way electroplating is progressing. We must not, we cannot be unmindful of what this means. To continue the influence and uphold the prestige that the A.E.S. has given electroplating, the membership of your society must include all those interested in electroplating. The future of the A.E.S. depends just as much upon having a "rule of thumb" policy in regard to membership ruled out as the advancement of the organization depended upon the abandonment of the "rule of thumb" operation of plating solutions.

Drag-Out

By GUSTAF SODERBERG

Read at Cleveland 1936 Convention

IN this paper I will report a series of tests on drag-out and a study of the effect of drag-out on the concentration of such substances as cyanide on one hand, and of metal on the other.

MEASUREMENTS

Most of these tests were run on flat sheet in different positions in order to establish some fundamental facts. Complicated parts may be considered built up from a number of simple shapes.

In these tests the drag-out was determined by rinsing off the solution, adhering to the test pieces with distilled water from a wash bottle, analysis of one bath constituent in the rinse water, and calculation of the volume of original solution which is represented by the analytical figures.

Effect of Time. The tests were made on bright zinc plated cold rolled sheets 4″ wide x 12″ long immersed vertically in the zinc plating solution. In one case the bottom edge was horizontal, in the other it was held at 15° angle from the horizontal. We also made tests on test pieces held at 30° angle. The general effect of time is the same in all cases.

The total drag-out time has been subdivided into two portions, namely, removal time, which is the time which elapses from the moment the top of the part moves out of the solution until the whole part just leaves the solution and transfer time, which is the time during which the part is allowed to drain above the solution.

The following conclusions can be drawn from the data in these curves:

a. The volume of the drag-out decreases with increasing removal plus transfer time. ½ sec. removal +½ sec. transfer gave drag-out of 10.8 ml.

b. At short removal time the transfer time is an important factor, but at long removal time the transfer time has no importance.

c. At relatively short drag-out time the removal time should be as long as possible and the transfer time as short as possible.

d. Even 60 seconds removal time is not sufficient to bring the drag-out to absolute minimum. Other tests have shown that the last drop falls off after 70 and 120 seconds transfer time at 5 and 20 seconds removal time respectively.

This may be translated into practical terms as follows:

A. The major part of the drag-out may be avoided by allowing for sufficient drag-out time.

B. Racks should be as light as possible so that the operator can hold them without getting tired.

C. For minimum drag-out time one gets less drag-out when the parts are removed slowly from the solution and then transferred quickly to the rinse than vice versa.

D. In the case of quick removal from the solution the parts should be hung on a rod over the tank or in a separate empty drag-out tank and the solution allowed to drain.

Effect of Angle. In these tests we varied the position of the vertical test pieces so that the lower edge made different angles with the horizontal. This has the effect that the long bead of solution which forms when the test piece is held horizontally is changed to a short one at one corner.

e. When the removal time it short, the tilted part drains faster the larger the angle with the horizontal.

f. When the removal time is long the angle has no effect on the volume of drag-out.

Another series of tests were run in which test pieces were held horizontally and tipped various degrees from the horizontal. It is seen that

g. An absolutely horizontal surface holds a large volume of solution.

h. Tipping the surface even a small angle decreases the drag-out very effectively, particularly when the solution bead is short.

From an operating standpoint, one should

E. Rack parts so that the solution can flow off at a tip or corner.

F. Tip all horizontal surfaces, but avoid the formation of solution pockets.

Effect of size. In the tests previously shown under "effect of

angle" three different size test pieces were used in vertical position. One was 4" x 12" one 2" x 12" and one 4" x 6". The first one has an area of 2/3 sq. ft., the two others are 1/3 sq. ft. In Table I is tabulated the drag-out in ml/2/3 sq. ft. against a removal time expressed in seconds/ft. The figures within parentheses are based on a removal time expressed in seconds.

TABLE I

Angle Degrees	Secs./ft.	Transfer 4"x12"	Transfer 2"x12"	2 sec. 4"x6"		Transfer 4"x12"	Transfer 2"x12"	10 sec. 4"x6"	
0	.5	5.85	5.80	(5.25)	5.80*	3.40	3.50	(3.30)	3.30*
	2	5.35	5.04	(3.60)	4.50	3.30	3.30	(3.25)	3.30
	4	4.25	3.95	(2.50)	3.60	3.17	3.05	(2.50)	3.20
	6	3.05	3.20	(2.00)	2.95	2.95	2.75	(2.05)	2.84
	8	2.55	2.70	(1.70)	2.50	2.55	2.40	(1.80)	2.50
	10	2.17	2.40	(1.55)	2.15	2.17	2.10	(1.55)	2.15
	15	1.75	1.95	(1.30)	1.75	1.75	1.95	(1.30)	1.75
	20	1.52	1.70	(1.05)	1.55	1.52	1.70	(1.05)	1.55
30	.5	4.45	3.60	(3.60)	3.60*	2.32	2.05	(2.00)	1.95
	2	4.07	3.75	(3.50)	3.60	2.45	2.15	(2.25)	2.10
	4	3.60	3.40	(2.90)	3.50	2.55	2.15	(2.20)	2.25
	6	2.97	2.50	(2.14)	3.30	2.50	2.10	(2.05)	2.35
	8	2.53	2.25	(1.80)	2.90	2.35	2.00	(1.95)	2.20
	10	2.30	2.15	(1.65)	2.45	2.12	1.90	(1.70)	2.15
	15	1.85	1.90	(1.30)	1.80	1.85	1.65	(1.35)	1.80
	20	1.70	1.60	(.90)	1.65	1.70	1.45	(.95)	1.70

*Extrapolated

The following conclusions can be drawn from these tests:

i. Removal time should be measured in sec/ft., not in seconds.

j. As long as removal time in secs/ft. is constant, the drag-out per sq./ft. is not greatly affected by the size and configuration of flat sheet.

This means in practice that

G. Parts which go deep into the tank should be removed slower and allowed to drain longer than short parts.

H. For minimum drag-out time racks should be extended horizontally rather than vertically.

I. When a number of small parts are racked together they should be placed so that they do not drip on each other more than necessary.

Effect of type of plating solution. In these tests three solutions were used on bright plates from the same solutions. The composition of the solutions were as follows:

Zinc:	4.5	oz/gal.	zinc
	9	"	total cyanide
	10	"	total caustic
			organic brightener
Nickel:	9.3	"	nickel
	1.8	"	chloride
	4.0	"	boric acid
			organic brightener
Chromium:	33	"	chromic acid
	.33	"	sulphuric acid

They represent three entirely different types of plating baths. The following conclusions may be drawn:

k. The drag-out curves for the three solutions have approximately the same shape, indicating that the conclusions made above are applicable to all solutions.

l. The volume of drag-out is only slightly higher for cyanide zinc than for nickel.

m. The chromium drag-out volume is definitely lower than the zinc or nickel drag-out.

Effect of temperature. In the following tests shown in Table II vertical nickel and chromium plated 4" x 12" test pieces were removed at 30° angle from a nickel solution, the transfer time being 10 seconds.

TABLE II

Temperature		*Removal time, secs.*		
°C	*°F*	3	7	20
25	77	2.10	1.92	1.40
35	98	1.97	1.86	1.23
45	114	1.90	1.67	1.11

These tests lead to the conclusion that

r. Increasing temperature decreases the volume of drag-out but is not a very big factor.

Solution Pockets. While rapid removal and transfer causes large and costly drag-out losses, the condition is still worse when solution is caught in pockets and does not even have a chance to drain. We have measured such drag-out for several cup-shaped parts and found figures of 30-90 ml. per sq. ft. of surface.

This difficulty is overcome by the use of drainage holes which should be placed at the lowest point of the pocket and be large enough that the pocket is well emptied during the drainage time allowed. In the case of stampings care should be taken that the hole made in one operation does not close in the next.

Wear of dies may move the hole to the wrong place or close them. Such things have to be watched carefully.

THE EFFECT OF DRAG-OUT ALONE

On the basis of the results obtained above we have made some calculations which are of interest from a cost standpoint. Two cases have been considered.

Case 1.

Additions are made to the solution so that its concentration is maintained and we are interested in determining the drag-out loss.

Make c = sq. ft. removed from each gallon of solution at a time
d = drag-out in gals/sq.ft. surface
cd = drag-out in gallons from each gallon
f = proportion of original solution removed by drag-out
n = total no. of removals

$$1.\quad n = \frac{f}{cd}$$

Table I (see following page) gives n at varying f and cd.

Case 2.

No additions are made to the solution and we are interested in knowing how quickly the solution concentration is going to drop to a certain percentage of the original.

Make a = original conc. of bath in oz/gal.
a_n = conc. of bath in oz/gal after n removals/gal.

$\left(1 - \frac{a_n}{a}\right) \times 100$ per cent of salts removed.

$$2.\quad n = \frac{\log \frac{a}{(a_n)}}{\log (1 - cd)}$$

Table II gives n at varying $\left(1 - \frac{a_n}{a}\right) \times 100$ and cd.

In order to calculate time make
m = no. of removals per hour
= loads per hour
h = no. of hours

$$3.\quad h = \frac{n}{m}$$

The amount of area plated at one time in a plating tank varies within rather narrow limits of c = .04 – .1 sq. ft. per gallon.

The factor d is drag-out in gallons per sq. ft. In our previous curves and charts most drag-out has been given as ml/2/3 sq. ft.

To convert to gallons per sq. ft. one must multiply by $\frac{3}{2}$ and divide by 3785. Some calculations are shown in the table.

TABLE I

Case 1

cd x 10^5

f x 100	1	2	5	10	25	50	100	200	500
99	99,000	49,500	19,800	9,900	3,960	1,980	990	495	198
95	95,000	47,500	19,000	9,500	3,800	1,900	950	475	190
90	90,000	45,000	18,000	9,000	3,600	1,800	900	450	180
75	75,000	37,500	15,000	7,500	3,000	1,500	750	375	150
50	50,000	25,000	10,000	5,000	2,000	1,000	500	250	100
25	25,000	12,500	5,000	2,500	1,000	500	250	125	50
15	15,000	7,500	3,000	1,500	600	300	150	75	30
5	5,000	2,500	1,000	500	200	100	50	25	10
1	1,000	500	200	100	40	20	10	5	2

TABLE II

Case 2

cd x 10^5

$(1-\frac{a}{a}n)$ 100	1	2	5	10	25	50	100	200	500
99	500,000	250,000	100,000	50,000	18,190	9,095	4,650	2,300	918
95	325,400	162,700	65,050	32,540	11,830	5,915	3,024	1,496	596
90	250,000	125,000	50,000	25,000	9,095	4,547	2,325	1,150	459
75	150,515	75,258	30,103	15,052	5,472	2,736	1,400	692	276
50	75,258	37,629	15,052	7,526	2,736	1,368	700	346	138
25	31,290	15,645	6,247	3,129	1,135	568	290	143	57
15	17,645	8,823	3,529	1,765	642	321	164	81	32
5	5,570	2,785	1,114	557	293	101	52	26	10
1	1,090	545	218	109	40	20	10	5	2

	ml/ 2/3 sq. ft.	d	cd x 10^4 at c= .04	.07	.10
Vertical parts, well drained	1	.0004	1.6	2.8	4
" " poorly drained	5	.002	8	14	20
" " very poorly drained	10	.004	16	28	40
Horizontal parts well drained	2	.0008	3.2	5.6	8
" " very poorly drained	25	.010	40	70	100
Cup shaped parts very poorly drained	20	.008	32	56	80
	-60	-.024	-96	-168	-240

A few examples will demonstrate how the calculations are made.

Case 1.

How long time does it take before one has added 25 per cent of the original composition to make up for drag-out at cd=5, 50 and 200 when (a) nickel plating for 20 mins. (m=3) and (b) zinc plating for 5 mins. (m=12)?

m	h hours at cd x 10^5 = 5	50	200
3	$\frac{5000}{3}=1667$	$\frac{500}{3}=167$	$\frac{125}{3}=42$
12	$\frac{5000}{12}=416$	$\frac{500}{12}=42$	$\frac{125}{12}=10$

It is easy to see how much the drag-out costs from the results given. Suppose the cost of the solutions are 50c per gallon and one operates a 1000 gallon tank. Twenty-five per cent of this bath costs $125. With constant replenishing as shown in case 1, the nickel plating loss will be $\frac{12500}{1667}$=75c per hour at cd=5 x 10^5, 75c per hour at cd=50 x 10^{-5} $3.00 per hour at cd=200 x 10^{-5}. In the case of zinc plating the cost is four times as great because solution is dragged out four times as often.

Case 2.

How long time does it take before the solution composition has dropped to 75 per cent of the original if no additions are made at cd=5, 50 and 200 when (a) nickel plating for 20 mins. (m=3) and (b) zinc plating for 5 mins. (m=12)?

	h hours at cd x 10^5		
m	5	50	200
3	$\frac{6247}{3}=2080$	$\frac{568}{3}=18_6$	$\frac{143}{3}=48$
12	$\frac{6247}{12}=520$	$\frac{568}{12}=47$	$\frac{143}{12}=12$

It is evident that the solutions with high drag-out must be analyzed very frequently and additions made at least of such constituents which are not replenished from the soluble anode, such as chloride and boric acid to the nickel solution and cyanide and brightener to the zinc solution.

CONSTANT METAL CONTENT

Now and then one reads the statement that "anode and cathode efficiencies are equal in this bath which makes for a balanced solution." Such a statement indicates an insufficient knowledge of shop conditions. Drag-out has been forgotten. A stable solution from a metal content standpoint is one in which

Metal dissolved = Metal plated out + Metal dragged out

or 4. $O_A = O_C + O_D$

where O stands for ounces of metal

Any solution operated with insoluble anodes is inherently 100 per cent unstable. There is no metal dissolved from the anodes but all of it has to be added in salt form. The reasons why we are so interested in getting all the metal from the anodes

are, first, metal from anodes costs less than metal from salts (chromium being an exception) second, less control is necessary, and third, one avoids building up the solution in anions, sulphate, hydroxide, etc., which in some instances may be detrimental.

In order to learn more about a stable solution, equation 4 has been developed as follows:

5. $$\frac{o_A}{\text{amp hr.}} = \frac{o_C}{\text{amp. hr.}} + \frac{o_D}{\text{amp. hr.}}$$

6. $$\frac{o_D}{\text{amp. hr.}} = \frac{o_{100}\,(e_A - e_C)}{\text{amp. hr.}} = Eq\,(e_A - e_C)$$

Where e_A = anode efficiency
e_C = cathode "
e_q = electrochemical equivalent in oz/amp. hr.

If the solution contains a oz/gal. metal and the drag-out = d gals/sq. ft. = ad oz/sq.ft. and area plated = b sq.ft./amp.hr.

7. $$\frac{o_D}{\text{amp. hr.}} = adb$$

8. $$adb = Eq\,(e_A - e_C)$$

9. $$ad = \frac{Eq\,(e_A - e_C)}{b}$$

Equation 7 tells us at least two things, namely:

1. The unbalancing effect of drag-out increases with increasing area per amp.hr. (b), i. e. with decreasing thickness of plate.

m. The drag-out increases with increasing metal content of the solution.

Equation 9 shows two other things, namely that in a stable bath

n. The drag-out is proportional to the difference between anode and cathode current efficiencies.

o. The higher the electrochemical equivalent of the metal being plated the higher must be the drag-out or the smaller must be the difference between anode and cathode current efficiency.

From a practical standpoint it can be concluded that

J. It is very difficult to maintain the metal content from the anodes if only flash coatings are applied.

K. The metal content of a solution should be as low as commensurate with the desired current density.

L. If the metal content tends to drop the anode efficiency should be raised by the use of larger anode area or higher concentration of the anode corroding component of the solution.

In order to demonstrate how equation 9 is used for balancing a solution, zinc cyanide plating will be used for an example:

Make the solution composition that is shown on previous page, that is a = 4.5 oz/gal.
the drag-out d = .0005, .005 and .02 gals/gal.
the cathode current density = 30 amp/sq.ft. with
the cathode efficiency E_C = 95%
the thickness of plate .0005" and .00015", requiring $\frac{1}{b}$ = .5 x 13.7/.95 = 7.22 amp.hrs. per sq. ft. and .15 x 13.7/.95 = 2.17 amp.hrs./sq.ft. respectively
the electrochemical equivalent for zinc is Eq = .043 oz/amp.hr.

Plate Thickness in.	Anode eff. E_A required at d = .0005	.005	.02
.0005	.957 = 95.7%	102.4%	124.0%
.00015	97.4%	119.1%	191.4%

A study of anode efficiencies shows that the maximum which can be obtained is around 108 per cent. That is had at such low current densities that there would be difficulty in finding space for the large anode area in the tank, even if ball type anodes are used.

Some relief can be had with the large drag-outs by plating at a higher cathode current density with lower cathode efficiency.

Make the cathode current density = 50 amp/sq.ft. with
the cathode efficiency E_C = 78%
the thickness of plate .0005" and .00015", requiring $\frac{1}{b}$ = .5 x 13.7/.78 = 8.78 amp.hrs./sq.ft. and .15 x 13.7/.78 = 2.64 amp.hrs./ sq.ft. respectively.
all other conditions as above.

Plate thickness in.	Anode eff. E_A required at d = .0005	.005	.02
.0005	78.6	84.0	101.8
.00015	80.0	97.8	157.2

It is evident that the low efficiencies can be had by the use of a combination of soluble and insoluble anodes and high enough

anode current density that the zinc anodes are partly polarized and oxygen is evolved from the steel, such as a small number of ball anodes.

The very high anode efficiency can not be reached and one must either cut down the drag-out, which is the best method, or keep up the metal content by means of salt additions. If this is not done, the metal content will drop to such a value that the new cathode efficiency is low enough that the difference in anode and cathode current efficiency takes care of the drag-out.

In conclusion four things should be stressed, namely:

1. The economical loss involved when drag-out is high.

2. The importance of long removal and transfer time to keep down the volume of drag-out.

3. The necessity of proper racking and use of drainage holes for the same purpose.

4. The desirability of balancing anode and cathode efficiencies, i. e. anode and cathode current densities, to maintain a constant metal content in the bath.

ACKNOWLEDGMENT

The experimental work reported in this paper was done by Dr. R. B. Saltonstall of The Udylite Company.

CHAIRMAN MATHERS: This paper is now open for discussion.

MR. ELDRIDGE: I think we have to thank Mr. Soderberg for drawing our attention, among other things, to parts of a streamline plating rack. He brought out another important point, and that is the necessity of getting a better idea of proportion of drag-out to plate-out in all plating solutions. We have noticed lately that with the use of high metal concentrations in solutions such as nickel and copper, where the metal is as high as eight and ten ounces, the platers are beginning to realize there is such a thing as drag-out. I think Mr. Soderberg also brings out the necessity of giving more attention to draining periods and the use of reclaimed tanks, speed of automatic racks, and so forth.

MR. R. O. HULL (Lakewood, Ohio): The importance of drag-out was emphasized in some experiments we made on a seven or eight-hundred-gallon installation of barrel cadmium some time

ago, in which it was found that the old method of rinsing the barrel and load amounted to a drag-out of about thirteen gallons per ton of work, which is pretty expensive plating. When this method of rinsing was changed so that only the work was rinsed and not the barrel, the drag-out dropped to about three gallons per ton of work under exactly the same conditions.

MR. G. A. SPENCER (Chicago, Illinois): I should like to ask Mr. Soderberg if he has investigated the effects of the surface structure of the base metal. A smooth surface, I should think, would not hold as much solution as a rough surface.

MR. SODERBERG: I thought so, too. I thought that a rough surface would hold a great deal more solution than the smooth. So we plated some of these coatings on hot rolled steel, which was pretty well pickled and was quite rough, and compared that with the cold rolled steel strips that we used, and found a very small difference. I can not explain it, but it did not make the difference that I expected. Evidently a solution flows down just about as fast as it has to go over high spots as when it does not have to. That is also pointed out, you remember, in the test pieces when just a little bit of tipping that way immediately reduced the drag-out.

MR. SPENCER: That, in turn, would lead to another question: You said that you have investigated the viscosity of the solution and had found that it had no effect on the drag-out.

MR. SODERBERG: We checked the viscosity of these three solutions.

MR. SPENCER: Have you investigated the surface tension of the solution?

MR. SODERBERG: We have not had time to do that yet. The fellow doing the work felt very badly about the short time he had. He said, "You ought not to be giving that paper yet." I said, "I have to do it because I promised."

MR. SPENCER: It presents an interesting subject for investigation.

MR. SODERBERG: We are going to follow up on it.

MR. SPENCER: If you can get some addition agent to add to your solution, that would increase the surface tension the same as an oil on a wet surface; it would roll off and leave a low drag-out.

MR. SODERBERG: I forgot to mention one thing: Both the zinc solution and the nickel solution were bright plating solutions and had no addition agents in them. That may have some bearing on results. On the other hand, the addition agent to the zinc solution was a colloid-forming material and the one in the nickel solution was not. That is rather a negative answer again.

MR. THURBER: I asked about the drag-out from the chromium solution being low and whether there is some reason for that.

MR. SODERBERG: We took considerable care in getting perfect flow in our test pieces. In other words, there were no breaks whatever on any of these surfaces. It was quite a job in the case of chromium on repeating tests with the test pieces, but we succeeded in doing it very well. So there were no water breaks, as you suggested, as the explanation for this low chromium drag-out.

DR. BLUM: Mr. Soderberg, if all of these were wet when they were taken out of the solution so that there was no water break, I fail to see how surface tension could affect the result. In fact, I think that a measure of the viscosity of the solution is the rate at which it flows off the surface, just the same as the rate at which it flows through a capillary. So if your surface was the same and the viscosity was the same, I fail to see how there could be any difference in rate. Really, the rate is a measure of viscosity. I can not see how the surface tension can affect it after you have a film there, because the rest of the liquid is not held in the metal; it is held in the liquid.

MR. SODERBERG: In other words, you would be more interested in the tension in the solution itself.

DR. BLUM: I think a straight measure of viscosity is the rate at which the solution flows off a surface that is wet. Of course, if there is a water break, that does increase surface tension.

MR. SODERBERG: It might be a good idea to repeat the viscosity tests.

MR. COSGROVE: Is that borne out by the fact that at increasing temperature you got better drainage?

MR. SODERBERG: Yes. Of course, there was some effect of temperature and it affects both factors. It affects the viscosity, too.

DELEGATE WALTER MEYER: Some time ago we ran some comprehensive tests on a correlation of drag-out with viscosity and surface tension, just the same as the study that Mr. Soderberg has done, except we included and measured surface tensions. To anyone who is going to do these experiments, I will prophesy disappointment, because we surely got it in our results. There did not seem to be any pronounced effects from differences in surface tension or differences in viscosity, although there was a slightly less drag-out when the individual surface tension was lowered, as you would expect, and when the viscosity was less and the solution was more mobile. But the effects are not pronounced, and I think Mr. Soderberg will find that when he repeats these experiments. We worked on nickel with concentrations from ten to fifty ounces per gallon, and with chromium from ten to fifty ounces per gallon of chromic acid.

MR. HOGABOOM: I am very much interested in this paper because I have already submitted a paper on the same subject for publication. Your figures bear out the results that we obtained. Viscosity does not seem to have any material effect upon drag-out, just as you found. What brought our attention to drag-out would probably be of interest. In a machine in which 1680 sheets thirty by thirty were plated in an automatic machine per hour, in a copper cyanide solution containing two ounces of metal and one and one-half ounces of free cyanide, in a run of eight hours the cost was $39 to replace the chemicals, while the labor was only $16. That shows you the effect of drag-out. That was run over a long time and figures were kept. Another interesting thing in drag-out is that in dipped gold work where the brass is bright dipped and put in a gold solution and taken out and drained well, there is more gold in the drag-out than there is on the work.

MR. SODERBERG: There is very little gold in those solutions and very little gold on the work.

MR. HESS: I should like to know if you find any relation between the acidity or alkalinity of the solution that you use in relation to the amount of drag-out. In other words, it seems to me as though you seem to have less drag-out in your chromium solution than in your solution of zinc cyanide.

MR. SODERBERG: We did not study any variation in alka-

linity or acidity in any one special solution. The nickel solution had a pH of 4.5, if I remember correctly, and the other was a zinc solution with a very high pH, and there was hardly any difference between them. So I do not know if that is going to be any factor of consequence.

DR. BLUM: Mr. Soderberg, with regard to the statement that viscosity does not have much effect, I will not question that there are small differences in viscosity, but one of the most serious criticisms made of the high sodium sulphate nickel solution is the large drag-out, and the high sodium sulphate nickel solution has a high viscosity. We have measured it so I will not say the two are proportional, but if you do increase the viscosity very greatly, for example by putting in two or three times as much sodium sulphate as you have nickel sulphate, you do increase the drag-out very much. That has been one of the serious criticisms of the high sulphate nickel solution.

MR. HOGABOOM: The work that we did was with the acid zinc solution in which we had a large amount of corn sugar.

MR. MESLE: There is just one observation which I should like to make. If we are to profit from the paper that has been presented, we should build our solutions with a minimum of metal, especially when we are plating light deposits, just as Mr. Hogaboom suggested. In the plating of gold we deliberately use as little gold as will give us the color we want, because we know the drag-out is going to be more than the deposit, and the same is true with other solutions.

I suggested some time ago in a paper that if we are building a silver solution for, say, automobile lamp reflectors, we should build it with less, perhaps, than an ounce of silver to the gallon. It is better to plate two or three times longer and have only one ounce of concentration and therefore lose as little silver as possible in the drag-out. What I am suggesting is that we build our solution for the particular type of plating we are going to do; that a thin plating should have a minimum of metal — a thin solution.

MR. SODERBERG: I have always had an argument with a good friend of mine about cadmium solutions. He likes a little higher metal solution than I do, and we have always argued

back and forth about the question of a little smaller tank against higher drag-out costs. I do not think we ever will get together, but I still hold to my viewpoint, which is exactly yours.

MR. HOGABOOM: Mr. Soderberg, the cost on drag-out with a high metal concentration solution is much greater than the cost of drag-out from a lower concentration metal solution, when you take actual cost figures.

MR. SODERBERG: Exactly.

DELEGATE WOOD: I should like to add a word to what Mr. Mesle said. A short while ago I had reason to believe that a high metal concentration would give me considerable benefit. This happened to be in plating tea ware in which the drag-out is necessarily high. I started with a concentration of about five ounces per gallon of silver, and I found it was absolutely impossible to hold it there, as you might expect. It very quickly ran down to about three ounces and then gradually tapered off to near two and one-half, which I find is a normal equilibrium for that type of work. To hold the solution over its equilibrium is necessarily a pretty expensive job. I think Mr. Mesle brought out a fine point in saying that if we adapt our solution to the equilibrium value we are going to have much less cost in chemical replacements.

MR. ELDRIDGE: In this discussion of thick and thin solutions, one point has been forgotten; that is, the cost of the plating solution depends not only upon the metal constituent but on other constituents, such as cyanide. I have a question which I should like to ask the writer. Has he any approximate figures for drag-out for such solutions as cyanide copper or cadmium or nickel or zinc?

MR. SODERBERG: I have had some figures on cadmium. They are not pure drag-out figures. They also include decomposition figures. I have seen variations from about half a pound of cyanide per pound of cadmium used in good operation down to about one-quarter of a pound of cyanide per pound of cadmium used. That gives you some idea of it. I also ran into a few instances where that figure was as high as three pounds of cyanide per pound of cadmium used, but that was not normal operation.

DR. BLUM: On the question of magnitude, it might be worth while to recall one of the few papers before this on the subject of drag-out. Mr. Nixon, who was then with the Western Clock Company, published six or eight years ago a paper on the drag-out of nickel solutions which he determined by measuring the change in the content of other materials in the bath. It came out, as I recall, about 270 per cent a year. In other words, he was taking out something over five per cent a week of the solution, so that that solution in a conveyor tank was being renewed nearly three times in a year by the additions that were necessary.

MR. SODERBERG: That figure checks quite well within the ranges I have been calculating here. Right about there is the normal rather quick operation.

MR. HOGABOOM: At the time Nixon did his work, we happened to do some work that paralleled it. Nixon published it and we did not. Nixon did some very excellent work and it checks perfectly. We took a 480-gallon nickel solution and put in magnesium chloride and then analyzed for magnesium. It takes seven months in a normal operation to replace that solution entirely. Those fellows who say they have solutions that are several years old are just dreaming.

MR. COSGROVE: I might point out that the shop man sometimes makes drag-out work for him instead of against him. In the cheaper solutions, such as cleaning solutions, I know I have one in particular that is never changed. The articles going through the tank are rather cup-shaped. So all you have to do is add a definite amount of cleaner daily and it maintains itself. In the washing machine and things of that nature, it is necessary to stop the machine and clean it out at quite frequent intervals. Sometimes where there is a lot of work going through once or twice a week, we like to have a little more drag-out.

MR. SODERBERG: You are plating those, too, aren't you?

MR. COSGROVE: Yes. It is hand operated and we can dip it out at each end of the line.

MR. SODERBERG: I am quite interested in this cup-shaped business. I got stuck with a job at one time with people plating hub caps. They started with no holes for the gas to get out of the top part. You know, the cross section of that thing is some-

thing like this (illustrating). It is just impossible to operate. For a while it is all right, but then the dies become worn, evidently, and those drains were closed up. Just about once a month I had complaints that it did not penetrate. I said, "How about the holes?" When they looked, the holes were not there.

DELEGATE H. G. MORTON (Grand Rapids, Michigan): Some people used to think that they were economizing by saving the first drag-out, saving the first rinse. I can hardly see that. What is your opinion?

MR. SODERBERG: Do you mean using two rinses, using one as a drag-out tank or recovery tank?

DELEGATE MORTON: Yes.

MR. SODERBERG: Isn't that largely a question of whether you can put your recovery back into your plating solution? If you have a chromium tank, you have quite a little spray and you have a high temperature and water evaporating. You can put back from your drag-out tank at frequent intervals. In other words, you can keep your drag-out tank at low concentration and really get some rinsing. If you go into a solution operating cold without spray, you are keeping the level in your plating tank up pretty well, and what are you going to do with your drag-out? I think that is the answer.

DELEGATE MORTON: If your first rinse becomes of any strength at all, you are just going to extra work.

MR. SODERBERG: Exactly.

MR. PACE: I should like to ask Mr. Soderberg if in his study of nickel solutions he noticed any difference in prevention of drag-out between boric acid and chlorides, or nickel, or if they dragged out proportionately?

MR. SODERBERG: We have not studied a thing along that line. I could not answer your question directly.

CHAIRMAN MATHERS: Is there another question?

MR. RHODES: In connection with your work on drag-out, have you done any work on recovery of spray losses in chrome solutions?

MR. SODERBERG: To tell the truth, I have not been worried about chromium very much. It has been somewhat outside our field. We have not done that.

CHAIRMAN MATHERS: In accurate gas analysis work, the directions say to allow three minutes for the run-down. Apparently, after three minutes there is no appreciable increase in the amount of run-down. In accurate work, three minutes are always allowed for this run-down of ordinary liquids. On the other hand, if one is working with very concentrated sulphuric acid, which has a very high viscosity, nine or ten minutes are required, and even after that length of time there is still a little run-down. So the viscosity, as Dr. Blum has said, does have a marked effect if the viscosity is very great. If you try to dip something into glycerine or sulphuric acid, you will find that a long time is required for the liquid to drain off.

A series of recovery tanks would recover practically all of this drag-out. However, the trouble and the expense might be too great, but a series of tanks following a principle that is known in engineering chemistry as the counter current system, would recover all, or practically all, of the drag-out.

MR. SODERBERG: I want to make the comment on the last statement that, of course, the question arises as to what to do with the contents of the drag-out tanks when you are all through.

CHAIRMAN MATHERS: These drag-out tanks should be very small in size. The first one will have the most concentrated solution in it, and after a while you may have to evaporate it. But normally you should be able to put a little back in your original plating tank, because there is always some evaporation from those tanks. Then you can move all those other solutions down and put a fresh one out at the end. That is done in extracting sugar from beets and in all sorts of extractions. It would be expensive and it might not be feasible, but it could be done.

MR. HOGABOOM: To bear out your statement, probably it would be interesting to note what has happened in one of the large safety razor manufacturing plants. They put in a full automatic and they put in three small tanks for drag-out. They are plating gold. Twice a day they run them into a tank and evaporate it. In one year's time they paid for the full automatic from the drag-out.

MR. SODERBERG: Of course, that is expensive.

CHAIRMAN MATHERS: The drag-out on silver might be re-

covered by passing these wash solutions through some precipitating agent that would recover all of the silver. Do you do that?

MR. MESLE: I am going to suggest that for some solutions why not just have a drip pot or a drip pan and just let the solution drip in it for a time and then pour it back into your bath.

CHAIRMAN MATHERS: I would do that before I would put the objects in the recovery tanks. I would get as much off as possible in a concentrated form. At least, allow three minutes for it to run off and then use a series of recovery tanks.

MR. SODERBERG: On that particular point I want to make this comment: I put in a rod in a few places above the tank. When the work comes out you hang it up there and forget it until you come back with your next load. There you generally can work it. It is a very good way of doing it.

MR. MESLE: When you do that in the case of some cyanide solutions, you have to be sure your deposit is thick enough so that the cyanide will not dissolve the metal while it is dripping down.

CHAIRMAN MATHERS: Why not pass the wash solution, in the case of silver, through scrap zinc and have all of the silver precipitated on the zinc? The same thing could be done with gold. In the cyanide gold mining process, the gold is precipitated by passing the gold solution through zinc dust, and they recover the gold very completely. That process will also recover silver.

Is there any other question?

DELEGATE WOOD: I should like to say, since you brought it up, that I am using that. In fact, I have a series of drag-out tanks and the final one is a hot rinse running into a tank which I treat periodically with dust. We get about one thousand ounces a year out of that.

MR. ELDRIDGE: I think the point we are missing is the actual intrinsic value of your solution, of your electrolyte. The electrolyte may cost $10 a hundred gallon, or $50 a hundred gallon. It might pay to run a metal recovery process in connection with your plating operation, or it might not. Some of these in your solutions, using soft nickels, run into rather expensive electrolytes which it certainly would pay you to recover in some form.

Anodic Treatment *of* Aluminum

A. OPENING REMARKS

By MR. HENRY A. SMITH, B. A. Sc.

Chemist with Coulter Cooper & Brass Co., Ltd.

Paper Read before Toronto Branch, A. E. S.

MR. ACHESON and Gentlemen, I desire to express my appreciation of the opportunity to renew my acquaintance with the members of this branch of the American Electro-Platers' Society. I have visited your meetings on two occasions and each time have carried away ideas new to me and a broader vision of the branch of industry with which we are associated. It is my hope that I may be able to impart to you some general idea of the Anodic Treatment of Aluminum, the process, its applications and limitations.

1. REASONS FOR ANODIC TREATMENT OF ALUMINUM

The fields of application enjoyed by two metals provide an interesting example. In eighteenth century Russia stovepipes were made of platinum — they were good stovepipes too, even if a trifle heavy. As late as 1854 aluminum was worth almost its weight in gold. Napoleon III's regal guests felt honoured to dine from aluminum dishes. Today platinum has but rare applications and aluminum is at every hand. It is quite logically so for aluminum is the third most plentiful element in the earth's crust, being only exceeded by oxygen and silicon. Due to its lightness, ductility, cheapness, high reflectivity and non-poisonous properties aluminum has found wide application. The ease with which it can be worked to a high lustre and its ability to retain a relatively pleasing appearance over long periods of usefulness, are well known. However, in several fields aluminum and its alloys, while having certain most desirable properties — lightness, strength, lustre, and easy workability were found to lack in corrosion resistance. Outdoors, aluminum may show rapid depreciation if situated so that it remains moist for extended periods, particularly in regions near the sea. This moisture produces an incipient surface attack

which, while not deep, sufficiently roughens the surface that it readily collects and holds dirt. This dirt film forms an excellent ally to the moisture for continued attack of the base metal. In applications where appearance and reflectivity are important, as in storefront construction and reflectors, this rapid depreciation of aluminum is most undesirable. Many examples of this can be seen on storefronts right in our own city. Resistance against such attack can be added by lacquering the surface, but even the best of lacquers and clear varnishes are not particularly durable under long exposure to light.

Another process of finishing aluminum is available, namely: by electrolytic or anodic oxidation which produces on the metal a hard abrasion resistant oxide coating.

2. HISTORICAL DEVELOPMENT OF ANODIC TREATMENT

Much of the credit for the early investigations and developments in the Anodic Protection of Aluminum must go to a Mr. H. Sutton of the Royal Aircraft Establishment. Aircraft in the Naval Air Service subjected their aluminum components to particularly severe corrosion and it was to overcome this that the Air Ministry developed the first method of Anodic Oxidation. This method employed 3% chromic acid, the aluminum being made the anode and the steel tank the cathode. The voltage starting at 3 or 4 volts and being raised during a 15 minute period to about 40 volts. This voltage was held for the next 35 minutes and then raised to 50 volts for the final 5 minutes treatment. The layer was comparatively thin and quite grey in appearance. Its usefulness was mainly in forming an excellent primer for protective layers of paint.

Other investigations have found methods of producing oxide layers anodically which are in common use in various localities of this terrestrial sphere. Flick in U. S. found that a dense adherent coating could be produced by anodic treatment in ammonium hydroxide or ammonium sulphide with a potential of 220 volts for a period as short as one minute.

In Japan both chromic acid and Oxalic acid treatments are used. In Germany mixtures of chromic and oxalic acid are in common use, requiring quite high voltages. In U. S. and in the plant with which I am connected the electrolyte is Sulfuric

Acid requiring a much lower voltage than commonly used by the previously mentioned methods. This process is known as Alumiliting. It was originally developed by Stafford O'Brien, the patents being acquired by Aluminum Colors Corporation of Indianapolis, and later by the present patent holders, the Aluminum Company of America.

This patent is a striking contrast to that on Chromium Plating. So far as I know, infringements have been vigorously suppressed and the license holders are secure under the protection afforded by the Aluminum Co. I will say this, though, while my firm held their rights from Aluminum Colors Inc. of Indianapolis, the development work was much more vigorously carried forward, and the license holders received constant encouragement and counsel from the laboratories of the patent holders.

3. The Alumilite Treatment will be described in detail and I will divide it into five branches —

a. Equipment
b. Racks
c. Rinsing
d. Colour work
e. Sealing

EQUIPMENT

The first requirement is a *lead lined tank* with either jacket or coils, which may be used for heating or cooling. The tank should have at least 12" greater depth and length than the largest load contemplated. Its width should be at least three times as wide as the depth of the largest article you plan to anodize. The solution used in this tank will be Sulfuric Acid and water, approx. 25° Be. Current density for general work is 15 amp per sq. ft. at 12-14 volts, and the temperature should be held between 74°-76° F. The cooling equipment should be adequate to hold this temperature with 200 watts per sq. ft. being dissipated. An air agitation pipe to provide uniform agitation is required. The generator should be a 12-15 volt directly connected to its motor drive and of adequate amperage to provide 20 amperes per square foot of contemplated work. You will notice that the generator should have 30% greater amperage than that required by the work, this is to allow for

racks which also require current. The direct drive feature is recommended since great initial shock loads arise on introduction of work into the tank.

One cold water rinse tank of at least as great depth as the treatment tank and a hot water tank with a coil capable of maintaining 180°-210° F. and about the same dimensions as the treatment tank. This hot water tank should be of wood construction and the coil of rustless material.

Since hydrogen and air comes from the treatment tank carrying sulfuric acid spray, exhaust equipment is necessary. A good thermometer, preferably with automatic temperature control equipment capable of maintaining the tank solution between 1° F plus or minus is necessary to the production of satisfactory work.

B. RACKS MUST BE OF ALUMINUM ONLY (Other materials dissolve)

Work being treated must maintain contact at the same point during treatment since an insulating layer is being formed and if contact is lost, even momentarily, no further contact can be established without stripping the rack. Much ingenuity is required in designing racks and with the exception that throwing power is no problem the design of racks holds much of the fascination of designing Chrome racks. The fact that an insulating layer is formed on the racks each time used makes it necessary to strip off all the layer plus a small amount of aluminum. Adequate allowance for this must be made in design.

Since certain aluminum alloys require higher voltage to get the same current density that can be obtained on 2S or pure aluminum, it has been found that 17S alloy is excellent for racks. To straighten out the ambiguity of this statement 17S at a potential of 11.3 volts takes 12.6 amps per sq. ft., 25 at 11.2 volts takes 15.6 amps per sq. ft., hence in a rack constructed of 17S the current density on the rack is considerably reduced, a thinner layer is formed with less to strip off. 17ST has very desirable spring properties which are used in holding work.

C. RINSING

Rinsing in clear running water is most important and the necessity of speedy washing out of any cavities cannot be over-

emphasized. Fabricated work with lapped or rolled joints or beaded edges presents a very difficult problem. If it is not possible to secure the work prior to the closing of beads, the use of a hose for rinsing beads offers the only hope of successful work. The layer stands the treatment solution, but is rapidly dissolved by dilute acid. Inadequate rinsing is evidenced by fringes of pale stains or non absorption of colour on dyed work.

D. COLORED WORK

The oxide layer formed by the Alumilite treatment when freshly rinsed from the treatment tank has the ability of absorbing organic dyes to take on almost any colour, to adsorb stains and fingerprints or oils. it may also absorb solutions of inorganic salts which on introduction of solution of reactive salts may precipitate coloured pigments directly in the layer, for instance a fresh layer impregnated with lead acetate then potassium permanganate will precipitate and retain a brown inorganic pigment known as lead peroxide, incidentally a very bright-fast colour. Similarly chrome yellow and Prussian blue may be formed in the layer. Organic dyes not completely mordanted by the oxide layer require additional treatment with a special sealer compound solution prior to the hot water seal.

E. SEALING

The fact that the coatings absorb materials so readily is not always advantageous. For certain types of service such as cafeteria trays it is essential that food products coming in contact with the coating should not stain it. Bengston discovered that treatment with boiling water will effectively seal clear coatings and prevent them from staining or dyeing. Such a treatment as is shown by X-Ray examination changed the amorphous alumina originally formed, in part at least, to the crystaline alpha monohydrate. Accompanying the change in the crystal structure is a marked increase in the corrosion resistance of the coating.

Edwards has shown that it is possible to further increase the corrosion resistance of the coatings by adsorbing substances such as silicates or chromates in them. Specimens sealed in

hot chromate solutions have withstood 52 weeks exposure to 20% salt spray.

The oxide layer in dry form is an excellent electrical insulator, the breakdown voltage is roughly proportional to the thickness of the layer.

Breakdown voltage of coating on commercially pure metal:

Thickness of Coating, inches	*Breakdown Voltage*
.0002	180
.0004	280
.0008	380
.001	420

These values may be increased as much as 50% by the sealing in hot water and if sealed by boiling in transformer oil or wax the increase is even greater but unknown to me.

4. PROPERTIES OF COATINGS ON ALLOYS

2S Commercially pure aluminum 99.2% is the most commonly treated material and produces the most desirable coatings since the layer is pure oxide.

Silicon turns the layer to grey or black if the precentage is increased. Copper and iron even in small percentages affect the color and desirability of the layer.

Welds made using silicon bearing rod are grey in color and distinctly noticeable. Welds should be made from the same material as the article itself. This is illustrated by the sample and the racks on display.

One of the outstanding and most valuable characteristics of the anodic coating is its high abrasion resistance. It is its corundum-like hardness that has made this coating so desirable on cafeteria trays, refrigerator trays, handrails and automobile pistons.

By comparison a finish of the durable type such as applied to metal furniture consisting of primer, two ground coats, graining coat and three coats of finishing varnish having an overall thickness of 3 mils had about one quarter the abrasion resistance of an Alumilite coating of 1 mil thickness.

Hardness of the layer is exemplified by the cry effect obtained on bending. Layers as hard as this cannot be formed without cracking the layer or even breaking the metal. But by a variation of the temperature or an increase in the strength of the acid we have produced coatings readily formed after sealing.

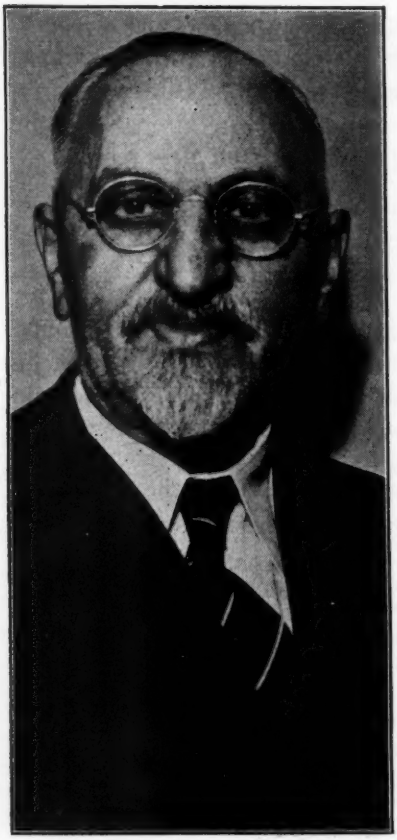
Coatings are not affected by temperature, in fact an easy method of checking the thickness is to melt out the base metal and "mike" up the remaining oxide layers.

One characteristic of the coating which has not been mentioned is its adhesion. In electric plating special precautions must be taken to ensure adhesion of the metallic coatings. In anodic coating there has been no such problem for the bond between the aluminum and the coating seems to be every bit as strong as the coating itself. Since the coating is formed from the aluminum grease or dirt may prevent formation of the film on local areas but will not affect the adhesion of such coating as is formed. Probably in no other way can you clean an aluminum surface, as well as by anodic treatment. This makes the coatings most desirable as primers for paint coatings.

A Member from Sweden Writes:

As you probably know I am and have been for a number of years a member of the Rochester Branch and am now over here, where I expect to stay for some time.

Sweden is a small country but in many ways a remarkable country. No unemployment at all. Very satisfied workers. No communists to speak of. No strikes. Every plant in every line is exceedingly busy. Even the building industry is so active that for instance in Stockholm they import skilled workmen in this line from foreign countries. Imagine that, asking foreign skilled people to come to your country. In the leading newspapers here you often see ads in which English, American and Canadian technical and sales people try to connect up with the big Swedish Export Industries. To sum up, a country, lovely in every respect and well worth a prolonged visit from American tourists.



MR. T. C. EICHSTAEDT

Mr. T. C. Eichstaedt who has been appointed by the President to fill the vacancy on the Executive Board caused by the death of First Vice President, P. J. Sheehan.

Mr. Eichstaedt has been a faithful worker in Detroit Branch for many years as Secretary-Treasurer. Under his leadership the membership drive should show great results. The cooperation of our entire organization with Mr. Eichstaedt is earnestly hoped for as we want every branch to show results before the convention in June.

Ted intends to get in touch with the Membership Chairman of each branch by letter in order to carry on the work started by the late Mr. Sheehan. We are beginning to see results from the Membership Campaign. Let's give the new Chairman our enthusiastic support.

OUR BEST WISHES TO NEW HAVEN

At a meeting of the Executive Board held at Baltimore, Md. previous to the educational session and banquet of the Baltimore-Washington Branch, Saturday, February 13, it was decided to grant the request of the New Haven members for a temporary charter.

We welcome New Haven Branch into the fellowship of the A.E.S.

The Effect of Nickel Chloride *in* Nickel Plating Solutions

By M. WAITE

Read at Cleveland 1936 Convention

INTRODUCTION

SEVERAL years ago (1931) a study was made oi nickel deposits produced ln fow pH solutions containing varying proportions of nickel chloride and nickel sulfate, and it was found that the grain size of the deposits decreased with increase in concentration of nickel chloride. In the 2.5 normal nickel solution which was used, the greatest change in grain size occurred as the nickel chloride was increased to approximately 1.0 normal. Further increase resulted in only a slight additional refinement of grain. The present investigation represents a repetition of the earlier work with the addition of data on the structure and properties of the nickel deposits.

There are few references to the effect of chlorides on the structure of nickel deposits in the literature.

Blum[1] found that coarse grained deposits were obtained at room temperature from high pH solutions containing small amounts of nickel chloride.

Thomas and Blum[2] measured the scratch hardness of nickel deposits produced in high pH solutions of varying composition. They found that, in 1.0 normal nickel solutions operated at room temperature and low current density, hardness was decreased by substituting nickel chloride for nickel sulfate. They concluded that the decrease in hardness was due to the larger crystals in the deposit produced in the more highly ionized nickel chloride solution.

Macnaughton, Gardam and Hammond[3] found that the addition of nickel chloride to a nickel sulfate-boric acid solution resulted in softer deposits over a wide range of pH. Their deposits were made at low current density and comparatively low temperature.

Blum and Kaspar[4] found that deposits, obtained at very high current densities from nickel chloride solutions operated at the boiling point, were smooth, fine grained, hard and brittle, while deposits obtained from nickel sulfate solutions under the same conditions were rough, coarse grained, soft and ductile. In solutions containing both sulfate and chloride, the presence of only 25 per cent of nickel chloride resulted in deposits almost the same as those from pure chloride solutions. Most of the deposits were produced at a pH of 1.0.

EXPERIMENTAL

In this investigation, nickel deposits produced at constant cathode efficiency, from low pH solutions containing varying proportions of nickel sulphate and nickel chloride, were examined.

The plating solutions used were prepared from a good commercial grade of chemicals. Two stock solutions, 2.5 normal in nickel and 0.5 normal in boric acid, were made up using in one solution, nickel chloride and in the other, nickel sulphate. Test solutions containing varying amounts of nickel chloride were prepared by mixing the two stock solutions in the required proportions.

The anodes used were of the carbon-type, containing over 99 per cent nickel. An average analysis of the anodes would show:

Ni (+Co)	99.4
Cu	0.02
Fe	0.08
Si	0.32
C	0.18

The submerged anode area was approximately the same as that of the cathode. The cathodes used were made of cold rolled shim stock steel. These were placed close to the side of the beaker so that most of the nickel was deposited on the side facing the anode. Current density calculations were based on the area of one side.

The experiments were conducted in 800 cc. beakers containing 735 cc. of the plating solutions. The beakers were placed in a water bath the temperature of which was controlled within 1.0°C. Cathode efficiencies were measured with a copper coulometer in the usual way. The pH determinations were made with the quinhydrone electrode.

The deposits were prepared at what may be called the equilibrium pH of the nickel plating solution. The equilibrium pH may be defined as the pH at which, under constant operating conditions, the rate of deposition of nickel at the cathode is equal to the rate of solution of nickel from the anode. In other words, at equilibrium conditions the solution remains automatically at a constant composition and pH. The anodes used in this work operated at the same current efficiency under all conditions so that deposits made at the equilibrium pH were made at a constant cathode efficiency.

The freshly prepared solutions were operated at the temperature under investigation with dummy cathodes until the pH of the solutions assumed a constant value. The required specimens were then prepared and cathode efficiencies determined. A cathode current density of 40 amperes per square foot was used both for the preliminary operation of the solution and for the preparation of the specimens.

Equilibrium pH values together with corresponding Cathode Efficiencies are given in Tables I and III.

Hardness measurements were made on deposits having a thickness of approximately 0.01 inches. The surface was polished through 10F alundum powder and tested in a Vickers Hardness machine with a 1.0 mm. ball and 10 Kg load. The values given in Table II and plotted in Figure 2 are the averages of four or more impressions.

TABLE I

Effect of Chloride Concentration and Temperature on Equilibrium pH Cathode Efficiencies at Equilibrium pH
Solution 2.5 Normal in Nickel—0.5 Normal in Boric Acid
Cathode Current Density—40 A/SF

Concentration of Nickle Chloride Normality	*Temperature 40° C*		*Temperature 60° C*	
	Equilibrium pH	*Cathode Efficiency*	*Equilibrium pH*	*Cathode Efficiency*
0.05	3.03	99.0	3.16	99.0
0.10	2.97	99.0	3.09	99.1
0.20	2.88	99.0	2.87	99.0
0.40	2.72	99.0	2.64	99.1
0.60	2.66	99.0	2.51	99.1
0.80	2.51	99.0	2.41	99.0
1.00	2.43	99.0	2.31	99.1
1.50	2.25	99.0	2.02	99.0
2.00	2.08	99.0	1.88	99.0
2.50	1.91	99.1	1.74	99.0

40°C = 104° F.

TABLE II

Effect of Chloride Concentrations and Temperature on Brinell Hardness
Solution 2.5 Normal in Nickel—0.5 Normal in Boric Acid
Cathode Current Density—40 A/SF pH at Equilibrium Value (See Table I)

Concentration of Nickel Chloride Normality	*Brinell Hardness* 40° *C*	60° *C*
0.2	123	102
0.4	121	103
0.6	140	116
0.8	134	124
1.0	150	150
1.5	146	169
2.0	166	166
2.5	177	194

TABLE III

Effect of Temperature on Equilibrium pH
Solution 2.5 Normal in Nickel Chloride—0.5 Normal in Boric Acid
Cathode Current Density—40 A/SF

Temperature	*Equilibrium pH*	*Cathode Efficiency*
40° C	1.91	99.1
60° C	1.74	99.0
80° C	1.53	99.1

Macrographs at ten diameters were made of the surface of each of the Brinell test specimens. Cross sections of the same specimens were polished, etched and photographed at 250 diameters.

RESULTS

The date given in Tables I and III show that at a constant temperature an increase in chloride concentration results in a owering of the equilibrium pH. At the same chloride concentration an increase in temperature also results in a lowering of the equilibrium pH. This variation in equilibrium pH is due to changes in cathode efficiency, the effect of increasing chloride concentration or temperature being to increase the efficiency. The magnitude of this effect is indicated by the fact that at 40° C and pH of 1.91 an increase in chloride concentration from 0.05 normal to 2.5 normal results in an increase in cathode efficiency from 86.4 to 99.1 per cent.

The effect of an increase in chloride is to increase the hardness of the resulting deposits. This effect is much less pronounced at 40° than at 60° C. With chloride concentrations not exceeding approximately 1.25 normal an increase in temperature results in softer deposits while above this concentration an increase in temperature hardens the deposits.

The relation between the hardness and crystal structure of the deposits is consistent with the generalization that an increase in

hardness is accompanied by a reduction in grain size. It is seen that the decrease in grain size with increase in chlorides is less marked at 40° than it is at 60°. At 0.2 normal chloride concentration the deposit at 60° shows larger crystals and is softer than the deposit at 40°. At 2.5 normal chloride the deposit at 60° is finer and harder than the deposit at 40°.

The surface structure of the deposits is refined by an increase in chlorides. The effect is progressive throughout the entire range of chloride concentrations, each change of 0.2 normal nickel chloride giving a plainly noticeable grain refinement, the rate of change being most rapid for low concentrations. At 1.0 to 1.5 normal chloride the structure is so fine that further refinement is not so readily apparent. The deposits at 2.5 normal were somewhat more rough or nodulized than deposits from baths containing less chloride and more sulfate.

Fine grained deposits produced from solutions containing high concentrations of nickel chloride are frequently dark colored. It is seen that the minimum current density for light colored deposits increases with an increase in temperature. At 40° C deposits are light colored at all current densities above 15 amperes per square foot while at 60° C deposits are light colored at current densities above 60 amperes per square foot. Above 60° C the minimum current density for light colored deposits rises rapidly, the value at 80° C being 300 amperes per square foot. As the chloride concentration is decreased by the substitution of nickel sulfate, the minimum current density for light colored deposits at a given temperature is decreased. For example at 60° C a decrease in chloride concentration from 2.50 to 1.00 normal has the effect of reducing the minimum current density from 60 to 40 amperes per square foot.

Porosity measurements were made using the ferroxyl test but the results were not sufficiently consistent to warrant publication at this time. There was some indication that the finer grained deposits were less porous.

The desirability of fine grained nickel deposits from the standpoint of ease of buffing is indicated by the work of Macnaughton and Hothersall.[5] These investigators deposited hard and soft nickel on brass and then determined the relative ease of buffing. They found that in all cases the harder deposits were more readily buffed.

SUMMARY

The effect of chlorides on the properties of nickel deposited at low pH has been studied.

Favorable conditions for the production of dense, fine grained nickel deposits of good color from low pH plating solutions have been determined.

The possible advantages of such deposits have been pointed out.

1. "The Use of Fluorides in Solutions for Nickel Deposition," W. Blum, Trans. Am. Electrochem. Soc., **39,** 459 (1921).
2. "The Protective Value of Nickel Plating," C. T. Thomas and W. Blum, Trans. Am. Electrochem. Soc., **93,** 69 (1925).
3. "The Influence of the Composition and Acidity of the Electrolyte on the Characteristics of Nickel Deposits," D. J. Macnaughton, G. E. Gardam and R. A. F. Hammond, Trans. Faraday Soc., **29,** 729 (1933).
4. "Structure and Properties of Nickel Deposited at High Current Densities," William Blum and Charles Kasper, Trans. Faraday Soc., **31,** 1203 (1935).
5. "Hardness and the Polishing of Electrodeposits," D. J. Macnaughton and A. W. Hothersall, J. Electroplater's and Dep. Tech, Soc., **5,** 63 (1929-30).

CHAIRMAN MATHERS: This paper is open for discussion. I think every plater has experimented with chlorides in the baths and I feel you are all capable of adding something to this paper and contributing to the discussion.

MR. COSGROVE: Did you say the finer grained deposits buffed more readily than the coarse grained?

MR. WAITE: I referred to the work of Macnaughton and Hothersall and Macnaughton and Hammond to deposit hard and soft nickel on brass. They found that the hard deposit which was fine grained was more readily buffed. They did point out, however, that they referred to hard and soft deposits that were smooth. In other words, if you have a hard deposit that is rough and contains any particles, that is going to be harder to buff than a softer deposit. Their theory is that the buffing operation is, in the first place, a grinding operation and that the final polish is more a flawing action. In the first step, the polishing grains act much like a lathe and dig furrows into your deposit. In the second step, the buffing itself consists of just a throwing over of the nickel. So when I mention that point, I refer to smooth deposits. If they are rough, you are going to have more trouble buffing.

Mr. C. H. ELDRIDGE (Detroit, Michigan): Mr. Waite, would you expect to find comparative results if common salt were added to the nickel chloride?

MR. WAITE: That is a good question. We have not made any experiments in the use of sodium or ammonium chloride. Our experiments have been limited to the simple nickel solution, in which nickel is the only metal ion. I should imagine that you would probably get a similar effect with sodium. With ammonium chloride, however, you have two objections to the use of ammonium chloride in all pH baths, one being the lower critical current density possible in the presence of ammonium chloride, and the other being the fact that the ammonium salts, in general, tend to increase pitting in a low pH bath. That is a very noticeable result. Sodium, I believe, would be better than ammonium as a substitute for nickel chloride.

MR. HOGABOOM: Did not Macnaughton use potassium chloride in his baths along with the nickel chloride so as to obtain that quality of deposit?

MR. WAITE: Macnaughton checked potassium and the potassium chloride resulted in softer deposits. Macnaughton's work and the work of Blum and Blum and Thomas are not consistent with the results reported now or with the results reported by Blum and Kasper in their more recent work, the reason being that they worked at low current densities, from ten amperes per square foot, and low temperatures. In their most recent work, Blum and Kasper used very high current densities and high temperatures, and their results are very consistent with the results reported here. However, it is not necessary to go to those extremely high current densities or to extremely high temperatures to obtain this refinement which is due to nickel chloride.

MR HOGABOOM: The chloride content has a material effect upon the anode corrosion. Where does the line cross an anode corrosion and hardness of deposit?

MR. WAITE: That is really getting into another subject. However, a properly made nickel anode will corrode satisfactorily, even in an all-nickel chloride bath. There is some difference in the rate of selective corrosion, with an increase in the nickel chloride concentration. In other words, you stand a better chance of corroding if you put a lot of nickel chloride in. With other anodes it is not necessary. We did not find any marked difference in the corrosion of the anodes, whether we were using .05 normal nickel chloride or 2.5 normal.

DELEGATE WALTER MEYER: Mr. Waite, did you have any particular reason for using such low pH baths in this study?

MR. WAITE: Well, to answer that question I might point out that the pH that we used was really automatically selected for us by the conditions of our experiments. In other words, we operated at a constant cathode efficiency. All of these deposits were made at a cathode efficiency of ninety-nine per cent. The reason that there is a difference in pH is because with the different composition of solution, the different temperature, the cathode efficiency is different. All these pH's varied from about 1.5 to approximately 3. In other words, as you increase the chloride, the pH at which the solution maintained a constant pH is changed. As the chloride is increased, the pH at equilibrium decreases. You can operate at a pH of one and one-half with an efficiency of ninety-nine per cent. These results, of course, have to be taken along with the conditions of our experiments. We operated at 40° C and 60° C. We used one current density, except in the experiments on the colored deposit. We operated at 40 amperes per square foot. At different current densities and a change of conditions, obviously you might expect a difference in results.

MR. E. E. ANDREW (Seymour, Connecticut): Can you tell me what the comparison would be with the chloride contents the same, using sodium chloride or ammonium chloride or nickel chloride, considering all other contents were the same?

MR. WAITE: I can not answer that question, as I pointed out in answering the previous question. We have not repeated this work using ammonium chloride or sodium chloride. However, I did point out that ammonium chloride is bad in a low pH bath, for two reasons: One, the bad effect on the critical current density; the other, the effect on pitting.

MR. ANDREW: How does the sodium chloride compare with the nickel chloride?

MR. WAITE: I did not do any work on sodium chloride.

MR. F. D. PACE (Grand Rapids, Michigan): Might not this change in structure be due to this change in pH that you got between these solutions rather than to the chloride content itself?

MR. WAITE: Perhaps the answer to that is that if you take these solutions and instead of operating them at the equilibrium

pH, if we can prepare the two solutions at the same pH we do get the same crystal size. That is a matter of experiment.

MR. PACE: You get some variation, though, at different pH's with the same solution.

MR. WAITE: Absolutely, particularly when you get up in the higher pH range. Understand, these results are all obtained in essentially a low pH bath. None of the pH values have exceeded three, so when you get up above a pH of five — from five to six — then you do have remarkable changes due to changes in pH.

DELEGATE WALTER MEYER: Talking about pH, I wonder why you use boric acid in a solution that is so acidic as that.

MR. WAITE: That suggestion has been made before, and I think the answer is that the pH of the cathode film still needs to be buffered, and boric acid really does have an important function, even in a low pH bath.

DR. BAKER: I might point out that a great deal more, I believe, becomes apparent as you study the content of this paper than is apparent on first thought. For example, if you have high cathode current efficiency at low pH, it means that one of the disadvantages of a low pH solution is overcome, namely, lack of, or reduced, throwing power, because throwing power ties up a great deal with cathode current efficiency.

I think I may give a partial answer, at least, to the one question twice repeated on the effect of substituting sodium chloride for nickel chloride. In the first place, of course, it is apparent that you could not substitute two and one-half normal sodium chloride for two and one-half normal nickel chloride in a bath having a total normality of two and one-half in nickel plate. But aside from that, the effect of high concentrations of sodium salts, I think, would be to give much more brittle and much less ductile deposits than were obtained here. I believe, also, that high concentrations of sodium have a tendency to give darker deposits.

MR. WAITE: I might add one thing that was not included in the paper. This question of equilibrium is something that you run into in using an oxidized type of anode. Under all conditions, the anode efficiency is always higher than that of the cathode. Therefore, the pH always rises. It so happens that with the carbonized type the efficiency is somewhat less than

one hundred per cent, and, therefore, somewhat less than the cathode efficiency under certain conditions. It is only because of that fact that you can obtain an equilibrium value in the solution. In the oxidized solution, the pH will rise very rapidly and continuously up to the point of precipitation in basic nickel compounds.

CHAIRMAN MATHERS: Are there any other questions?

I wish to ask Mr. Waite if analyses were made of these nickel cathodes to determine whether or not chlorine had been absorbed or had become a part of the deposits?

MR. WAITE: We have not made an analysis of the cathode deposit. We think our inclusions of basic nickel compounds of some nature is the reason for obtaining dark-colored deposits at the lower current densities, but we have not made any examination of the deposits for chlorine or any other impurities.

CHAIRMAN MATHERS: We have found that chlorides are present in most metal deposits from solutions containing chlorides. Also bromides and iodides are present in metal deposits from bromide and iodide solutions. It would be an interesting experiment to try the effect of nickel bromide and perhaps nickel iodide in a series of experiments similar to the ones that are described here. The effects might be very much greater than those shown by the chlorides, or they might be very much less. At least, there will be some marked effect as compared to the chlorides. Of course, the iodides would be too expensive to use, even if they were satisfactory, but bromides probably would not be too expensive. Has anyone ever tried a nickel bath with bromide present?

ALL WELDED DIPPING BASKETS AND TRAYS FOR PLATING

The Udylite Company, 1651 East Grand Boulevard, Detroit, Michigan has just announced a complete line of Dipping Baskets and Trays for plating use.

Unusual strength and long life and ability to carry heavy loads without bulging under rough usage are qualities attributed to all welded construction. This consists of eliminating all possible weakness by cross member reinforcement at points of greater stress. Wire or mesh, bottom and side cross-members are welded to basket or tray frame making all parts one integral unit throughout.

Udylite dipping baskets in the bail type are furnished with swivel or rigid handles. Trays are furnished with either solid or mesh sides. Both baskets or trays can be furnished made of steel, brass, copper, aluminum, monel metal and nickel chrome in standard shapes, gauges of wire and mesh. Special all welded containers can be made following specifications other than standard.

Udylite also offers a Duro-Welded reinforced rigid bail type steel basket covered with hard or soft rubber highly resistant to all acids except straight nitric and sulphuric — furnished in two sizes — 10 x 10″ and 12 x 12″ in 1/2″ mesh or larger.

Bright Nickel Plating

By O. J. SIZELOVE

At Newark Branch A. E. S.

WITHIN the past two or three years, bright nickel plating solutions have come into general use. Bright nickel deposits have been produced for the past fifteen or twenty years but only of recent years have heavy deposits of bright nickel been successfully accomplished. This has been brought about by the development of bright nickel solutions which are operated at high temperature and which allow the use of a high current density.

Bright nickel plating is produced in hot nickel solutions in which the single nickel salt concentration may vary between 20 and 40 ounces per gallon. The nickel chloride content is usually between 4 and 6 ounces per gallon and the boric acid present is usually at the limit of solubility of 4 to 4½ ounces per gallon.

The brightening agents used vary from the sulphonated compounds, and the formates, and in many cases other agents for purposes which may be quite varied. Some are called buffers, others depolarizers, and still others, anti-pitting agents.

The pH range in which any one process operates is usually limited and varies from a pH of 2 to 4.5. There is also considerable difference between the different processes as to how successfully they may be operated outside the recommended range. Current density varies from 20 to 140 amperes per square foot and will produce bright deposits with the best of them, although average plating densities are usually within the range of 30 to 45 amperes per square foot.

Aside from brighteners, the most important other property of the deposit is ductility. A great many factors influence ductility and an effort is made in all cases to maintain the process so that the ductility is at the most favorable degree.

The control of a bright process is more difficult and more complicated than the ordinary hot nickel plating solution. As

in the case of chromium, the bright deposit shows defects that in ordinary plating would not be noticeable nor objectionable for the deposit is subsequently to be color buffed.

It has been demonstrated that it is possible to effect appreciable savings in bright nickel plating for certain types of work, and it is felt that there is a real future for such processes.

Each process lays claim to giving the best result but I do not believe that the best results have been obtained up to the present time. In other words, further improvement is sure to follow from the research being done to eliminate any objectionable features that either process may have.

Most of the members are somewhat familiar with one or more of the different processes and for a general discussion of the paper, three processes that are most commonly used will be referred to, namely, the Pyrene Process, the Harshaw Chemical Process, and the Weisberg Stoddard Process, which is licensed by the Hanson-Van Winkle-Munning Company.

Besides these three processes, there are one or two others, but they are not so well known as those referred to above.

There is one bright nickel process that is being introduced to the trade that is operated with the usual operating conditions of the regular nickel solution, that is, normal temperature and current density. Cathode agitation, however, is necessary. This solution is made by using a prepared salt which is imported and I have seen some very good work done with this process. The cost is quite high compared to the regular solution. Replenishing of the solution is accomplished by using single nickel salts and a toning salt which contains the addition agent. This solution will find some use in the novelty trade where the thickness of the deposit is not an important factor and where the cost of installation is considered, as small units can be installed with very little expense. The solution is made by using Starbright Nickel Salts which is a trade name for same.

The processes referred to above are all operated with high temperatures and current densities. There are certain claims made by the licensees of these processes which will be referred to at this time.

PYRENE BRIGHT NICKEL PROCESS

The Pyrene Bright Nickel Process is based on the Schloetter Patent No. 1,972,693 and was introduced to industry about three years ago by the Pyrene Manufacturing Company.

During the interim of its introduction and use, there has obviously been a number of marked improvements in the electrolyte and technique of using same. The present coatings not only possess the brilliance they have always had, but a study of the relationship of the bath variables have made it possible to definitely impart various physical properties to the deposit.

When the process was first introduced, it was necessary to install solutions in prepared liquid form and the period of aging for these baths was quite variable. Pitting was also encountered in some solutions though this could, of course, be eliminated by the addition of peroxide or sodium perborate.

Later on a conversion method was developed whereby any plating bath could be converted to the Bright Nickel solution. This was an important step. The aging period was done away with, the bath being ready for operation a few hours after its conversion. A further study of the work made it possible to practically eliminate any pitting troubles.

One of the most important properties of the Pyrene High Gloss Nickel Electrolyte is the fact that the organic factor can be considered self regenerative and does not deplete in use. In fact, any adjustments are based entirely on drag out or mechanical losses. With other electrolytes where brilliance is obtained by an addition agent, this has to be added constantly as it tends to be co-deposited in the plate. It is obvious then that any bath, where the governing constituent is never constant, cannot definitely produce a definite crystallization or deposit quality.

Pyrene Bright Nickel deposits are practically free from carbon or organics, the deposit containing nickel oxide in the grid. It has been shown by a number of tests that any bright nickel deposits containing organics in complex form or carbon are more susceptible to break down after chromium plating. It is possible,

on the other hand, with the Pyrene deposit to chromium plate for long periods with little or no danger of lifting.

Another interesting phenomena is the great increase in the throwing power of any chromium plate subsequently applied. We do not know just at the moment the actual reason for this, but the fact remains that it works in practice. In many cases it has been possible to do away with racks and simply string the work on wires, the throwing power under these conditions being excellent. It is also important to note that these improved results with chromium are obtained at lower current densities than those necessary with the old type of buffed nickel.

As stated in the first part of this paper, bright nickel deposits have been produced for a good many years using cadmium or gum arabic, but their use was limited to a certain class of work where the thickness of the deposit was not considered, the brightness being the objective.

In using either of these brightners the regular type of nickel solution that is in good operating condition can be used. Where the solution is operated for still plating, room temperature is used and the metal content is 2½ to 3 ounces per gallon with an equal amount of chloride. The pH is operated slightly higher than the ordinary nickel solution. A pH of 6.0 to 6.2 seems to give best results. With this type of bright nickel plating, cadmium, or cadmium and cobalt, or gum arabic is used and some very excellent results are obtained, as shown by samples submitted.

When cadmium is used, an excess causes a brittle deposit and also poor throwing power. An excess is easily noticed by the deposit being brittle and a dark colored deposit forming in the recessed part of the work. If an excess of cadmium is used the deposit also has a tendency to stain and when used alone as a brightening agent, the color of the deposit is of a slightly yellow cast. If cobalt is added with the cadmium in small amounts the color of the deposit is greatly improved; the yellow cast will disappear and a blue white color will be produced.

Cadmium may be introduced into the nickel solution by using the metal or one of its salts. When it is introduced into the solution from the metal by using the cadmium as an anode, it is

difficult to control, as it is impossible to know exactly what quantity is going into the solution.

If a stock solution is made by dissolving a weighed amount of a cadmium salt in a definite volume of water, and a measured amount of this stock solution is added to the solution, it is easy to calculate the quantity that is added and from experience to only add the proper amount to get the results desired.

Either the chloride, sulphate or the acetate of cadmium may be used in preparing the stock solution. Four ounces of the salt is dissolved in one gallon of water and if cobalt is to be used, one pound of cobalt sulphate is added to this gallon of stock solution. Two fluid ounces of this stock solution is usually enough for 100 gallons of the nickel solution.

For barrel plating a metal content of six ounces of metallic nickel, six ounces of chloride, four ounces of boric acid, and a pH of 6.2 to 6.4 with the above amount of the cadmium stock solution will give very good results. The samples shown are of cast iron which have been rumbled in an iron barrel and plated in a barrel solution that contained cadmium. The cold-rolled steel key ring holders, the brass pins and the small cups were also plated in a nickel solution that contained cadmium, and I think for cheap work the finish is very good.

Gum arabic can also be used to obtain deposits of nickel and it was used by the writer for a good many years with excellent results.

The regular type of nickel solution is used and when using this brightener care must be used also, as an excess will cause streaky deposits. Vertical black streaks will appear on the work and where these streaks are, very little or no nickel at all will be deposited. An excess of this brightener can be easily overcome by adding hydrogen peroxide to the solution. In using this brightener a stock solution is made by dissolving four ounces of powdered gum arabic in one gallon of water, using cold water and allowing it to stand for several hours with occasional agitation so that all of the gum will go into solution. Eight ounces of this stock solution is enough for 100 gallons of the nickel solution. This brightener does not produce a deposit that is as brittle as when cadmium is used and if care is taken so that an

excess is avoided, some very excellent bright nickel deposits are obtained.

If trouble is encountered it is usually the fault of the man in charge as he is not satisfied with using the amount that is necessary, but he must continue to add the brightener to satisfy his curiosity and there is soon an excess in the solution and trouble ahead. If operating conditions are right, no trouble is encountered in chromium plating over a nickel deposit where gum arabic is used as a brightener.

As stated before, the deposit is quite malleable and even with an excess of the brightener the deposit is not brittle as is the case where cadmium is used as a brightener. This brightener is recommended for still plating solutions and cadmium is recommended for use when barrel plating is being done.

The writer has also used this brightener in conjunction with nickel plating zinc die-castings which were afterward chromium plated. A light nickel color operation was necessary before chromium plating. The cost of nickel coloring operation was considerably cheaper and the appearance of the finished work was greatly improved.

The class of work referred to was safety razors, where it was impossible to polish in the recessed part of the razor head. The finish on the design of the handle was also considerably improved, as the background was nice and white and showed no dull appearance after chromium plating.

This instance is cited to show what may be done on work that has recessed parts and where the background must be finished satisfactorily.

Where novelty or cheap work is being done this brightener will be found to work very satisfactorily as the work can be plated for 10 to 15 minutes in a nickel solution and then chromium plated without any nickel coloring operation. It has the advantage that it is cheap and it can be used in any good operating nickel solution. Like any of the other brighteners that are used, it decreases the throwing power of the solution and a slightly higher current density must be used than what is used for the ordinary nickel solution. Usually one-half to one volt over the ordinary voltage will be found sufficient.

Solvent Degreasing Prior to Electroplating

(*A. H. BLAKE, G. S. BLAKESLEE & CO.*)

Boston Section; A. E. S. Hotel Manger, Boston, Dec. 3, 1936.

Your president, Mr. Arthur Mintie, has asked me to give you a little information on solvent degreasing, particularly as it applies to the plating business. Actually seeing this process in operation will give you more information in a much shorter time than any prepared speech I might deliver. I have, therefore, brought with me a small machine and, while it is coming up to proper operating temperature, I will sketch briefly the history of this method of cleaning and outline your particular problem in the plating room.

Shortly before the world war the effectiveness of Trichlorethylene as a solvent for oils and greases was discovered by Pechiney in France and Wacher in Germany. Dr Wacher first made practical use of this discovery in industry about the year 1923. His machines and process have since been patented in many countries. He did not originally understand just how to control the vapors and so built his early machines as liquid dip tanks only, some having three or four tanks in series.

The use of these machines spread through Belgium and France to England, where it was taken up by the Imperial Chemical Institute, a concern similar to our DuPont Company, who now have control of most of the patents in England and the British Empire. The I. C. I. research engineers found that liquid alone would not do a sufficiently good job of cleaning for certain classes of work such as plating and they therefore developed the vapor phase as a final operation. This vapor phase always gives a 100% grease free surface.

The Carrier Engineering Co., Newark, N. J., purchased some of these machines for use in their plant in England and later for use in their plant at Newark, N. J. Here their engineers promptly went to work to improve on the foreign designs and

adapt them for the use of American industry. Carrier made a number of changes and took out several patents covering these changes. During the years from 1928 to 1932 they built and sold several hundred machines in this country. All of these were vapor phase only. These machines had a very inefficient cooling system for controlling the vapors and were therefore very expensive to operate. The Carrier Company has retired from the degreasing business and their machines are rapidly being replaced by our newer designs.

Chemists employed by DuPont and several other companies have carried on research since 1930 to discover the best means of preventing breakdown of the solvent which can occur under certain conditions such as overheating, catalysis, or photochemical reaction. A large number of inhibitors have been discovered and patented. The DuPont Company now manufactures the purest trichlorethylene made anywhere and inhibits it in several ways for different types of cleaning. It is sold under several trade names.

So much for history and now on to an analysis of the present problem.

You all know better than I the importance of grease free surfaces for plating so that needs no discussion here. However, an analysis of the problem facing the plater may be helpful in indicating the place of the solvent degreasing process in the plating room.

There are in general three layers of material to be removed from any metal surface before plating:

1.— **Solids** which are formed from and adhere directly to the metal itself; rust, scale, oxides or salts. These are insoluble in water or alkali solutions but in most cases readily react with dilute acid or cyanide to form water soluble compounds. Such dirt is now removed in modern plating shops by acid pickle, cyanide cleaning or descaling by some means such as the Bullard-Dunn process.

2.— **Greases, oils and fats** used as lubrication during the manufacture of the parts.

These can be divided into three groups:

a.— *Hydrocarbon or mineral oils.*

These are not soluble in water and are unaffected by either acid or alkali solutions. Mechanical agitation, particularly in the presence of detergents, will disperse or emulsify them in alkali solutions. Such emulsions are not particularly stable, however, and some oil will separate and rise to the surface and thence be returned to the work as it emerges from the dip tank. These oils are readily soluble in a large variety of organic liquids, such as naptha, ether, chloroform, carbon tetra-chloride, trichlorethylene, and others.

b.— *Animal and vegetable fats, oils and greases.*

These are compounds of glycerine with fatty acids. They are insoluble in water but can be dispersed in it. They react with alkalis and some acids to form water soluble compounds. They are, also, soluble in the same organic liquids named above (a).

c.— *Derivatives of animal and vegetable oils.*

This group comprises soaps, sulphonated oils, free fatty acids, etc. Many of these are soluble in water and react with alkalis to form water soluble compounds. They are, however, usually found in mixtures with one or both of the preceding groups and their removal is, therefore, primarily accomplished by dispersal or emulsification.

3.— **Solids** which are held on the metal surface by the mechanical action of the grease film.

These are mostly shop dusts and dirt and can usually be removed by mechanical action such as wiping or brushing.

The above analysis of the cleaning problem is very brief and incomplete but may serve to indicate that the preparation of a metal surface for plating may, and usually does, involve at least two distinct processes: i.e. the removal of the grease and solid dirt held on by this grease, then the rust, scale or metallic salts.

Of the two processes mentioned in the previous paragraph, solvent degreasing, in some form, will positively guarantee a grease (and solid dirt) free surface but will not remove rust, scale or metallic salts.

There is a distinct advantage in using a degreaser rather than present methods for this part of the cleaning process but solvent degreasing is necessarily an extra step in almost all cases.

Intelligence Test

The following mental test is designed to test the alertness of A.E.S. members. Follow directions. If you make a perfect score (100 points) you are entitled to the best in the house.

I — INFORMATION TEST underline the correct words to complete thought:

(a) In the Spring a young man's fancy lightly turns to thoughts of REFRESHMENT, LOVE, SLEEP.

(b) June 14, 15, 16, 17, 1937 will bring to NewYork City — BLIZZARD, A. E. S. CONVENTION, ALFALFA CROP.

(c) THE PENNSYLVANIA HOTEL has been chosen by the Convention Committee as — AVIATION FIELD, CONVENTION HEADQUARTERS, a GOOD PLACE TO EAT, DRINK AND DISCUSS YOUR PLATING PROBLEMS. (25 points).

II — BEST REASON or COMPREHENSION TEST check the best reason:

A. E. S. Members and friends should attend the 25th Annual Convention because:

(a) It is being held in New York City.
(b) They can expect the time of their lives.
(c) It is the Silver Jubilee and Oh Boy!
(d) Boy, will they be sorry if they miss it.

(25 *points*)

III — PROVERB TEST match the following proverbs with the statements that explain their meaning:

(a) Proverbs

There is no smoke without fire.
A word to the wise is sufficient.
A friend in need is a friend indeed.
One good turn deserves another.

(b) Statements: mark the following statement which explains above proverb.

The 25th Annual Convention is now the burning question.
New York City in June is a wonderful place.
The New York Branch depends on the A.E.S.
What one elbow bender says to another at conventions.

(50 *points*)

Add up your score. If you find it perfect make your reservation for the Convention NOW. If your score is not so hot — make your reservation anyway. After all who's perfect!

1937 CONVENTION COMMITTEE

LOUIS H. CATES
Publicity Chairman

Here and There

The Baltimore annual meeting was held on Saturday, February 13. Past Supreme President T. J. Slattery presided and called on all the members of the Executive Board for a few remarks. President Thompson asked the members present to rise and pay silent tribute to the memory of our late vice-president P. J. Sheehan. The papers read were very interesting and created considerable discussion especially Mr. Abner Brenner's paper on the new magnetic method of testing the thickness of nickel deposits on non-ferrous metals. It looks as though Mr. Brenner has something of real value and he knows his subject.

In coming to bat for Mr. Buzzard who was unable to be present, Mr. J. H. Wilson did a good job in presenting the paper on anodic coating of Aluminum and magnesium alloys.

That genial gentleman with the camera, Mr. C. A. Vincent Davis, is becoming a familiar figure at all our gatherings and is always given a big hand. In connection with the exposure tests, the use of color photography is very interesting and keeps the audience well informed as to the work being done at the various places in the country where the specimens are set up, and the changes that take place in the parts exposed. Dr. Blum explained the pictures as they were thrown on the screen.

Evidently the ladies got alarmed at the absence of the men, because they also attended the closing period of the educational session. Mr. Vincent Davis was equal to the occasion; he put on a flora and fauna picture which was received with applause by the ladies and their husbands. The educational session was so interesting it was 6:30 before the president called for adjournment.

The Banquet was good. So was the entertainment and there was plenty of both. Baltimore-Washington Branch spared no expense in making everyone happy. Congratulations to the whole committee—Master of Ceremonies and all.

Philadelphia was well represented. Past Supreme Vice-president Jos. E. Underwood was there. Past President of the A. E. S. George Gehling also showed up and was called upon to tell the story of the bee. He did.

As usual the secretary, Irving Hahn, was kept busy. Mr. Hahn is another of those wide awake secretaries we like to meet. He is a tireless worker and is always on the job.

Our Research Associate, Paul Strausser and Mrs. Strausser, Dr. and Mrs. Blum, Mr. Pierdon, Mr. Chace, and a host of others including the President of the Branch, Albert L. Fry, were present and enjoyed the banquet and the evening's entertainment. One of the last numbers on the program and one of the best was Tom Slattery's contribution. Tom is always popular as a singer. He received a great hand as usual.

Our good friend, Past Supreme President Walter S. Barrows, of Toronto Branch, sends the following contribution:

THE FAITHFUL FEW

"When the meeting's called to order
And you look around the room,
You're sure to find some faces
That from out the shadows loom!
They are always at the meeting,
And they'll stay until it's through,
The ones that I would mention
Are the Always Faithful Few.

They fill the many offices
And are always on the spot,
No matter what the weather is,
Though it may be awful hot.
Or it may be dark and rainy,
But they are tried and true,
The ones whom you rely upon
Are the Always Faithful Few.

There are lots of worthy members
Who will come, when in the mood,
When everything's convenient,
They can do a little good;
They're a factor in the meeting,
And are necessary, too;
But the ones who never fail us
Are the Always Faithful Few.

If it were not for these faithful ones,
Whose shoulders at the wheel
Keep the institution moving,
Without a halt or reel —
What would be the fate of meetings
Where we claim so much to do?
They surely would be failures
If we lacked the Faithful Few!"

The Abstract Section

JAMES W. HANLON, *Chairman, Program and Educational Committee*

1. Electroplating in a Modern Radio Plant. W. W. BOONE. *Products Finishing* — Jan. 1937 pp 5 - 15 — Article describes electroplating department at the Crosley Radio Corporation in Cincinnati, giving diagrammatic layouts of plating tanks and a very fine detailed discussion on proper procedure in each process unit. This article should be of wide interest to foremen of other shops. Of special interest is the use of a refrigerator coil to freeze out carbonates in the cadmium tanks.

PHIL J. RITZENTHALER.

2. Modern Abrasives — Their origin and uses. W. J. ANTENER — *Products Finishing* — Jan. 1937 pp 36-40 — Article discusses abrasives from the old established emery down to the modern high cutting abrasives like carborundum and alundum. Discusses origin, preparation and general uses. Several photomicrographs of abrasive grains are shown. PHIL J. RITZENTHALER.

3. Design, Construction and Maintenance of Exhaust Systems. J. M. DALLAVALLE—*Abrasive and Cleaning Methods*, Dec. 1936 pp 11 - 17 — Within past few years much attention has been given to improving health hazards in plating departments or other places with harmful fumes to handle. This article by a man connected with U. S. Public Health Service gives excellent discussion on problems involved. Properly designed exhaust system actually pays dividends as health of workmen is better. In improving conditions both prevention of occupational disease and increase in production is obtained. Engineering data on design is presented, including design of hood, air velocities duct system, gage of metal, determination of air flow and costs.

PHIL J. RITZENTHALER

4. Practical Pointers on the Use of Solvents and Alkaline Solutions in Metal Cleaning. G. B. HOGABOOM, JR. *Abrasive and Cleaning Methods* Dec. 1936 pp 20 - 22 — Many theoretical discussions leave plater in doubt as to practical aspects of cleaning. Author discusses practical aspects of removal of heavy oils by alkaline cleaners and degreasers. Contaminated solvent must be removed by sawdust tumble for successful results. In using soap-bearing cleaners, rinse waters should be hot and free from calcium or magnesium salts or insoluble salts will form. Author pleads for control of details.

PHIL J. RITZENTHALER.

METALS & ALLOYS ABSTRACTS

1. Plating & Polishing Departments Tell an Interesting Story. *Mill & Factory*, Vol **19**, pp. 53-5, Sept. 1936—General description is given of layout of Stewart-Warner's plating and polishing department. Equipment used, power requirements and a discussion of various procedures should be of interest to every foreman in charge of a plating shop. A very diversified production is handled in the plant. PHIL. J. RITZENTHALER

2. Pickling & Etching Baths for Duralumin. H. SUTTON & T. J. PEAKE. *Journal Institute of Metals*, May 1936, pp. 243-52—A search was made for a pickle bath that would not require hydrofluoric acid. Treatment in a bath containing 1% by weight of sodium fluoride to a 10% sulfuric acid solution followed by dipping in 50% HNO_3 gave satisfactory etching. The Woehler fatigue limit for 10 million cycles was reduced from 10.85 to 10.1 tons/sq. in. by pickling, a reduction of only 7%. Bath most satisfactory yet found. PHIL. J. RITZENTHALER

3. Chemistry and Mechanics of Metal Cleaning. D. J. BENOLIEL. *Ceramic Industry*, Vol. **27**, July 1936, pp. 24-26—Paper presented before Enamel Division of American Ceramic Society. Discusses all factors of cleaning before enameling. Since introduction of emulsifying cleaners, mineral oils compete with soaps and fats as lubricants in drawing operations. Soaps often cause rinsing difficulties through formation of excess soap. Action of metal cleaners depends on solution, chemical action, emulsification, mechanical action or a combination of these. Need for high Na_2O content in cleaners is stressed. Ordinarily, only chemical action leaves the surface chemically clean. For greatest efficiency, cleaner should be at boiling point. Hot rinse is much better than cold. A simple test to measure speed of cleaning is given. PHIL. J. RITZENTHALER

4. Tungsten Deposited by Novel Process. *Automotive Industries*, Vol. **75**, Sept. 12, 1936, pp. 353—Tungsten may be deposited by a novel process in conjunction with one or more metals from the same electrolyte. Standard nickel plating equipment may be used with certain modifications. Deposits are dense, adherent and very resistant to corrosion, erosion and heat. Steel test plates coated with 0.0002" of W-Ni with an intermediate coating of 0.0001 Ni, stood 172 hrs. in the salt spray without tarnishing. These coatings may be carburized to give added hardness.

PHIL. J. RITZENTHALER

5. **Elytal Process.** H. GINSBERG. *Aluminum*, Vol. **18**, pp. 441-2, Sept. 1936—The Elytal process permits electroplating Al or Al alloys directly without any intermediate metallic layer. Its principle is to produce a non-metallic intermediate layer instead of removing the oxide film present on Al surface. Degreased parts which have been freed from their oxide film in a NaOH solution saturated with NaCl are treated in an acid electrolyte with A.C. or D.C. in such a manner that the Al surface is covered with an oxide film which, in turn, is removed or loosened in an alkaline solution. This treatment creates a surface on which a firmly adhering metal layer can be deposited electrolytically. The deposits have a very dense structure and can be brightly polished. They are corrosion resistant and not attacked in 10% caustic soda. They do not tarnish and adhere even at 150°C. Process is patented by D.R.P. 546,388. PHIL. J. RITZENTHALER

METAL CLEANING AND FINISHING

New Materials Aid Progress in Metal Cleaning. DR. R. W. MITCHELL—There have been no radical changes in metal cleaning procedure during the past year. New and improved materials, particularly synthetics, have found wider application. Salts of sulfonic or sulfates of fatty organic radicals, have partially replaced soaps or resinates as emulsifying agents in alkaline baths. In general, these substitutes are hard water proof, and possess higher wetting and emulsifying power. In the drawing of wire graphited soaps have proved unusually successful. Solvent degreasing using chlorinated hydrocarbons has been extended and is particularly effective for certain types of work. Emulsion degreasing has found its largest expansion during the past year. This method possesses the advantages of solvent cleaning and soap washing in one procedure. Roughly, they consist of an oil soluble synthetic soap, chlorinated hydrocarbon solvent, and a coupling agent (higher alcohols, glyrol ethers, etc.) as an emulsifying agent. These compounds have extremely high wetting and penetrative power.

E. T. SHEEHAN

Testing and Stripping of Electrodeposits, Part I, Silver. DR. B. EGEBERG and N. E. PROMISEL—The authors stress the necessity of evaluation tests for weight (thickness) of deposit, porosity, adhesion, hardness flexibility, electrochemical potential compared to that of the base metal, chemical resistance, chemical and physical properties of the corrosion product, etc. No proper evaluation can be made without knowing the base metal, and the nature of underplates. Methods are described for the determination of underplates and base metal, and the proper means of stripping the deposit. Stripping, microscopic and chord methods are used to detremine local thickness. Adhesion to base is tested by burnishing, bending, and de ep drawing For testing hardness, the authors use a modification of the Brinell test. Various abrasives are used to check wear resistance. All methods of testing used are given in detail.

E. T. SHEEHAN

Business and Social News

BRANCH NEWS

Educational Activities

AMERICAN ELECTRO-PLATERS' SOCIETY

BINGHAMTON-ELMIRA BRANCH

The Binghamton-Elmira Branch of the A.E.S. held their monthly dinner meeting at the Y.M.C.A., Binghamton, N. Y., 6.30 P. M., Monday, February 1.

After enjoying the dinner, Mr. Fletcher opened the meeting and asked all to try and get new members enrolled in the A.E.S. Then he turned the meeting over to Mr. Harnett, who in turn introduced the speaker of the evening, Mr. Oliver J. Sizelove of Frederick Gumm Chemical Co.

Mr. Sizelove reviewed the chromium situation. He told of the different lawsuits that have been tried over patents and explained the results of these lawsuits and what in his opinion would be the future of chrome. Mr. Sizelove then conducted a round table discussion on plating in general. Many questions were asked concerning different troubles in plating. As usual Oliver gave very helpful answers to them all.

The meeting was very successful and we all hope to see Mr. Sizelove more often.

LARRY MEYER, *Sec'y*

SPRINGFIELD BRANCH

The Springfield Branch held its regular meeting on Monday evening, January 25, 1937, with President Seidel in the chair.

The minutes of the previous meeting were read and approved.

A letter from the Milwaukee Branch was read, stating that they would like to have our support to obtain the convention for 1938. The Secretary was instructed to acknowledge the letter, stating that at this time, we were not in a position to take action.

A letter from the Boston Branch was read, inviting all members to the Banquet. An educational meeting to be held March 6 at the Hotel Bradford. As some brilliant speakers were to be there, it was decided that as many members as possible should attend.

The Secretary was instructed to write a letter of condolence to the family of Vice President P. J. Sheehan who died recently.

The applications of five prospective members were read and the usual course was taken. The applications were: Associate Members: Dr. Leonard B. Pfeil, Research Director of The Mond Nickel Co., Birmingham, England. Mr. Luke D. Mosher, The Mosher Co.

Active Members: Mr. Adalor Granger, Indian Motocycle Co. Mr. Louis J. Jenner. Mr. William H. Curtis, Millers Falls Co.

Mr. Harold Duggan, of the Oakite Products Co. read a long and interesting paper on the most recent ideas of cleaning to prevent visible and invisible oxide films.

After some discussion, the meeting was adjourned at 10:20 P. M.

HENRY DELARM, *Sec'y*

BOSTON BRANCH

Boston Branch met Thursday the 4th at the Manger hotel with President Mintie in the chair.

Minutes of the previous meeting read and approved, communications read and placed on file, bill read and ordered paid.

Three applications read for the first time and turned over to the board of managers as follows: Edmund Jevelli, 70 Reed Ave., Winthrop, Mass, Associate; Norman J. Houle, 31 Sullivan St., Keene, N. H., Associate and John Greig, 100 Overlook Rd., Arlington, Mass.

Chairman Hardy of the chemistry class reported that the class is now going along fine with twenty-five members all taking great interest in their work.

Our Chairman of the banquet committee, Louis Gale, being on the sick list a report was made by Joe Barron and he states that everything is working out fine and that it will be the best banquet that the branch ever held and if any member misses this time he will miss a hundred dollar time. Be there he says. He also hopes that the members will make their returns early so that we may keep the hotel informed as to how many plates will be necessary. Please help the committee.

Bert Sage of the Educational Session is doing a fine job and all arrangements are now complete and Bert says that the session will start at 2 P. M. *Sharp*—so get there early.

After the regular order of business, President Mintie introduced one of the speakers, Mr. William Cahill, instructor of the chemistry class. He gave an outline of the talk that Mr. Phillips will give at the Banquet so that the members will be able to follow his talk. He spoke of the action that takes place in the solutions and his talk was well given. He answered all questions for the members and was given a rising vote of thanks for his interesting talk.

President Mintie also spoke on the "Adhesion of Electro Deposits." The object of this paper was to bring out some of the practical conclusions we may apply to our every day work and also some material for discussion and it was a very interesting talk and will be discussed more at the coming meetings.

Mr. Gilbert also spoke on "Hard Chrome" and he said that anyone doing this kind of work would have plenty of headaches until they got on to the little tricks that help in doing this kind of work. He said that he had plenty until he found out that you must get on to the way of doing it or you will be in plenty of trouble.

There were plenty of questions for all speakers and they received a vote of thanks for their very fine talks.

Meeting adjourned at 11 P. M.

A. W. GARRETT, *Sec'y.*

ST. LOUIS BRANCH

Regular meeting of St. Louis Branch A.E.S. was held Friday, February 5th, at Central Y.M.C.A. Dinner was served at 6:15 P. M. President Menninges being absent, Vice-President Barth opened the meeting. Roll Call of officers showed two absent.

The Membership Drive was discussed and we expect to have some new members in line before long.

Letter was read from New York Branch in regard to convention.

No further business.

A suggestion was made that each member be asked to talk on some subject for 10 minutes and then discuss the talk after, and in that way all the members can get in on the discussion and get some very good information.

Mr. John Vogt started the ball rolling by giving a talk on Bright Nickel which was very interesting and all joined in and a very lively discussion followed. John Vogt was given a vote of thanks.

We missed our good friend E. J. Musick at our meeting, and hope he will be feeling better and attend our next meeting, which will be held at the Cen-

tral "Y" on the first Friday in March which is the 5th. Dinner will be served.

C. T. McGINLEY, *Sec.*

DAYTON BRANCH

The regular monthly meeting of Dayton Branch was held at the Y.M.C.A., Saturday, February 6, 1937 at 8.00 P. M.

At this meeting we had as the principal speaker, Mr. George B. Hogaboom, who spoke on the subject, "What Does the Ammeter Tell?"

A good crowd was on hand and everyone enjoyed the efforts of the speaker, who illustrated his remarks with slides.

Much credit for bringing Mr. Hogaboom to Dayton is given to our Librarian, Mr. Connley.

Dayton branch has plans to bring several speakers here for the benefit of its members, and we feel sure that the members will appreciate the efforts of our Librarian, by being present at the meetings.

Mr. Hogaboom also brought us a message of greeting from Our Supreme Secretary, Mr. Wm. J. R. Kennedy, and at the conclusion of his talk he was given a rising vote of thanks by the members of Dayton Branch.

The Librarian introduced at this meeting, the use of the Question Box and although the questions were few, they were of a very constructive nature.

Another interesting speaker will be here for our next meeting.

WARD PROTSMAN, *Sec'y-Treas.*

LOS ANGELES BRANCH

Minutes of the regular monthly meeting of the Los Angeles Branch A.E.S. held January 13 at the Rosslyn Hotel.

Pres. E. R. Williams presided. Seventeen members were present.

Minutes and financial statement of the previous meeting were read and accepted. The Board of Managers reported that they had audited the secretary's books and found them O. K.

Several of the members who had been appointed to look into various places that might be suitable for us to hold an educational session and dinner dance gave their reports. After some discussion the members voted to go ahead with the affair, the location to be the Elk's Club and the date March 20th.

The meeting was turned over to the librarian. He found only one question in the box:

Q. Does anyone know of a good method of sealing aluminum after anodizing?

No satisfactory method was suggested.

We are sorry to report the death of one of our charter members—Mr. Benjamin Foss who died in January.

EARL COFFIN, *Sec.-Treas.*

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MILWAUKEE BRANCH

The regular monthly meeting of the Milwaukee Branch was held at Lipps Hall, No. 3rd and W. Highland Ave. on February 11, 1937.

President Dex. Rhodes presided and all officers present. Minutes of previous meeting read and approved. Harry Unke elected an active member. He has been in Milwaukee all his life and is well known and liked. Harry is foreman at the Milwaukee Stamping Co.

Our smoker committee reported that the annual "smoker" and good time will be held at the Schroeder Hotel, April 24, 1937. Plan now to attend, the meeting is late enough to enable all within driving distance to meet at another Milwaukee Smoker. The complete program will follow in the next issue of the REVIEW.

Question: How to keep bright nickel from showing water spots?

Answer: Undecided, can anyone help us?

A. J. Hermansen showed us several samples of the new color-plating process and much interest was manifested.

The meeting adjourned and we were treated with Milwaukee refreshments.

A. J. HERMANSEN, *Sec.-Treas.*

HARTFORD BRANCH

The Hartford Branch of the A.E.S. held its regular monthly meeting on Monday evening, February 8, 1937, at the Elk's Club in Bristol, Conn.

The meeting was called to order at 8:30 P. M. with President Peterson in the Chair. Minutes of the previous meeting were read and accepted. All communications were read and placed on file. One bill amounting to thirteen dollars and thirteen cents ($13.13) for our third quarter per-capita tax was voted paid.

Three applicants were elected to membership; two as active members and one as associate.

Mr. W. L. Cassell, Eastern Manager of the Udylite Co., was speaker of the evening and gave a very interesting talk on "Barrel Plating Efficiencies." His talk was thoroughly enjoyed as well as the discussion and questions which followed his talk. In conclusion he was given a rising vote of thanks.

It was voted to change our meeting night from the second Monday to the third Monday of the month for a period of three months.

The meeting was attended by sixteen members and adjourned at 10:30 P.M.

V. E. GRANT, *Sec.*

BRIDGEPORT BRANCH

Minutes of the Bridgeport Branch A.E.S. January Meeting.

The regular meeting of the Bridgeport Branch was held on Friday, January fifteenth with about eighteen members present.

After the reading of the minutes and communications, George Wagstaff made a motion that the Branch hold a banquet and educational session on April 24,1937.

The motion was passed.

It was then moved that if the New Haven Branch has its charter or temporary charter the Banquet and Educational Session is to be considered a joint Banquet and Educational session of the Bridgeport and New Haven Branches, and members of both branches are to serve on committees.

The motion was passed.

President Wm. Bridgett is Chairman of the general committee in charge and Librarian Walter Meyer will take charge of the Educational Program.

There were no applications for membership.

Three new members were elected. They are: Axel V. Boggild, G. E. Co.,

Albert Schneider, G. E. Co., Kenneth Kusterer, Acme Shear Co. All three are associate members.

After the business meeting was adjourned Walter Meyer discussed the paper the Branch is to present at the coming convention in New York. Most of the members present offered valuable suggestions and information about Brass Plating.

CHAS. H. COSTELLO, *Sec.-Treas.*

DETROIT BRANCH

The regular meeting of the Detroit Branch of the A.E.S. was held in the Hotel Statler, Friday evening, February 5th, there being a wonderful turnout, about 100 being present, which was very gratifying, Mr. A. B. Wilson, President, presiding.

The minutes of the last meeting, which was held in December, were dispensed with, as they had been published in the January REVIEW.

As there was no regular meeting held in January, the Board of Managers had a meeting and recommended the election to membership of the applications which were read at the December meeting.

The attached new applicants for membership were received and read.

A letter from the Baltimore-Washington Branch was read and placed on file, as was a letter from the Milwaukee Branch also.

Our President, Mr. A. B. Wilson, announced that Mr. Patrick Sheehan, Supreme First Vice-president had suddenly passed away, and that our Secretary, Mr. T. C. Eichstaedt, had been appointed by Supreme President, Mr. E. Steen Thompson, to fill the unexpired term; and also to act as chairman of the membership committee. Mr. Eichstaedt was asked to make a speech, which he endeavored to do. Among other things, he said that the appointment, as well as the death of Mr. Sheehan was a surprise, and that while he feels the responsibility of the office, he will do the best he can to fill it to the end of the fiscal year. He also made a plea for every member to be an advertising agent for our Society, and to solicit ads for the monthly REVIEW through the salesmen he comes into contact with. He also made a plea for every member to be a committee of one on the new membership drive, and to the Associate members who call on the trade, always to have a supply of application blanks, and ask every one he comes in contact with, whether or not they are members of the Society, and if not, to give them an application blank. He stated that a salesman is the best membership committee, as he comes in direct contact with more platers who are not members than anyone else.

Mr. William Phillips was then introduced as speaker of the evening. He, as everyone knows, is a member of the Detroit Branch, and also chairman of the research committee and has charge of the research funds. His topic for the evening was electroplating in general, and he had a moving picture machine from which he projected on the silver screen pictures which had been taken by Mr. Davies, of the DuPont Company of the racks of specimens of work which are out in different parts of the country for testing purposes by the Bureau of Standards of Washington, D.C. The pictures were colored—that is, they had their natural colors, showing the finish and the deterioration and rust spots. He will have his paper published in a future edition of the REVIEW.

Mr. Phillips' paper and photos were received with great applause. He then gave us a report of the finances of the research committee. I have not got the

figures, but there are funds enough to carry on for a little longer than the end of the fiscal year. He stated that we never wanted for funds and that he did not expect any shortage, as he expected every subscriber to renew his annual contribution, and is getting out a letter to the members asking them to contact their employers for a contribution to the fund. If the employer is explained the purpose and object of this research committee, and is shown some of the achievements which have been wrought during the past six years, he will gladly contribute to this fund.

Without a doubt, these tests which have been carried on during the past six years by the Bureau of Standards, with the assistance of our associates whom we pay, is the greatest achievement that has been done by the A.E.S. Any contribution can be accepted by any member and either turned in to the Secretary of the Branch or mailed to Mr. Phillips. There is not a concern in the country which does not profit by this research work that is being carried on, as it is public property and anyone can have a report by addressing the Bureau of Standards. Therefore, no one interested in the Electro-Plating Industry will refuse to contribute if he knows what he is contributing for. Therefore every member should make it his business to acquaint his employer with just what it means and try and get an annual subscription. As stated before, we do not need any funds for the rest of the fiscal year, but we must make sure of our treasury for carrying on the work during the next year.

Mr. B. F. Lewis, our acting librarian, then collected the question cards and among all those present, each one having had a card, there was but one question. This was very disappointing, both to myself, Mr. Lewis, and Mr. Wilson. In fact, Mr. Wilson said although there were 100 present he didn't think that they all knew everything, and that someone certainly had some question that was puzzling him, and made a plea for better co-operation in writing questions on the question card. These question cards with questions on them are really the life of the meeting, as they bring out quite a lot of discussion and many answers.

There being no more business, the meeting adjourned at 9:30.

Applicants for Membership: Thomas Raymond Gill, Associate, c/o Udylite Co., 1651 E. Grand Blvd. Detroit; M. J. Lillis, Active, c/o 12340 Cloverdale Ave., Detroit; L. A. Mead, Active, 2055 Ontario Street, Walkerville, Ont.; Frank F. Farmer, Active, 2640 Superior St., Detroit; Stanly Edward Dolman, Active; 470 Kitchener Ave., Detroit; L. J. Meyers, Active; 3628 Logan Ave., Ft. Wayne, Indiana; Walter L. Pinner, Active; 14624 Prevost Ave., Detroit; Charles F. Rippe, Active; Hartwell, 5720 Dearborn, Michigan; Fae Boris, Active, (a woman), 3039 Gladstone Avenue, Detroit and Vincent B. Arnold Active; 12875 E. Outer Drive, Detroit.

Re-instated: E. L. Beightol, Active, 138 Glendale Ave., Highland Park, Mich.

T. C. EICHSTAEDT, *Sec.-Treas.*

WATERBURY BRANCH

A well attended meeting of Waterbury Branch, A.E.S., was held Friday evening, Feb. 12, in Engineers' Hall. President Tennant Elwin presided. George Muscio, instructor of the chemistry class, reported on the progress of the same. Past president Wm. Gray reported that owing to the fact that many of the members attending the class are working nights it may be deemed advisable to call off meetings until the fall. In con-

nection with the membership campaign, all members present were instructed to notify Henry Mahlstedt, chairman of the local committee, of all prospective candidates. Favorable action having been taken on the application of Jesse E. Stareck, for associate membership, he was declared elected. Application for associate membership was received from Edward Dowling of the Scovill Mfg. Co. Circular relative to the annual banquet and dance of the Baltimore-Washington Branch was read. Invitation to educational session and banquet of Boston Branch was received. Communication calling attention to Milwaukee Branch application for the 1938 Convention was read. Communication from Educational Committee of the Silver Jubilee Convention to be held in New York City in June was received. Circular calling attention to the first International Electrodeposition Conference to be held in London on March 3rd and 4th was read. Two of the questions received by the librarian that enabled those present to listen to some interesting discussion, were "Is there any method for the determination of zinc and copper in a brass solution other than the lengthy titration one?" and "What causes pitting and gas streaks in cyanide copper plating?"

The speaker of the evening was Donald Wood of Taunton, Mass., who gave a talk on "Throwing Power". The speaker's qualifications for talking on this subject are well known to the members who attended the last convention in Cleveland, and it is unnecessary to say that the enthusiasm with which his talk was received there, was repeated here.

A very interesting talk on the bright rolling of small brass and steel parts was given by Wm. J. Gray. His remarks included sand, wet, and ball rolling.

Commissioner James M. Lynch of the Compensation Court has recently handed down a decision of interest to all persons engaged in chromium plating. He finds that Alonzo Davis is entitled to medical care in a nasal condition resulting from his employment by the Chromium Corp. of America. Praise is given the company for the precautions being taken to safeguard the employees, and suggests that plant's employees keep their nostrils greased.

Commissioner Lynch finds in his memorandum that the process of chromium plating is comparatively new and that safeguard treatments are in their experimental stage. He notes, however, that the company has informed its employees that if the nostrils are moistened there is little chance of injury. It is also noted that the company provides all employees with jars of vaseline, to be placed in the nostrils three times a day, morning, noon and night, to avert the possibilities of injury.

"As in most cases," comments Commissioner Lynch, "familiarity breeds contempt, and few of the men make use of this safeguard. His suggestion is that in some manner all employees should be gathered together at certain times during the day and treatment given by a specialized first aid man.

WM. H. GUILFOILE, *Sec.*

PITTSBURGH BRANCH

Our meeting of February 5th was held in the U. S. Bureau of Mines, and in the absence of our President, Herman Peter, secretary asked Past President George Gehling to take the chair. Mr. Gehling gladly did so, and the business of the evening was taken care of with dispatch, and this part of the program

did not take long, for we were to hear more from our Past President.

The following applications for membership were received: Edward Douglass Canaga, Fulton Building, Pittsburgh, Pa., for associate membership; Francis J. Cary, 478 N. Ellsworth Ave., Salem, Ohio, for active membership.

Past President Gehling addressed the members and their friends upon the many problems of the day; this was in the form of a round table discussion in which every one present took part, and from the interest taken, a lot of benefit was gained in the answers to the many questions. After the meeting adjourned, some of the party, held an adjourned meeting in Webster Hall, where refreshments were served, in honor of our guest.

Mr. Gehling had such a fine time that he stated that he would be present at our meeting in March; he just cannot help coming all the way from his own town of Philadelphia to be present. Our members appreciate his interest and trust that our attendance in March will be better.

S. E. HEDDEN, *Sec.*

CHICAGO BRANCH

The regular monthly meeting of Chicago Branch was held February 13, at the Atlantic Hotel.

President G. Jelinek presided and all other officers present except the secretary, who attended the Baltimore-Washington Branch Educational Meeting and Banquet on this date.

The new applications of Mr. J. M. Schlosser, Mr. E. H. Witte, Mr. M. F. Ehrler, and Mr. J. E. Lorang read and committees appointed on same.

Two new amendments to our constitution read, approved, and ordered sent to our Editor, Mr. Kennedy, to be published in our REVIEW.

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Mr. O. E. Servis read a very interesting paper on Alumilite Process finishing by Mr. J. Bryden. Mr. Bryden showed many samples and answered many questions all of which were very interesting.

The librarian found the following questions in the question box.

No. 1. *What causes nickel plated steel parts to turn black when being agitated?*

Ans. There might be several causes for this but it was suggested that too low a current or lack of contact was the cause in this case.

No. 2. *Can brass stampings be successfully nickel plated in a bright nickel then chrome plated using the same racks; these racks are not insulated?*

Ans. Yes, but it is not good practice.

No. 3. *Why does work plate black in a tin solution? Work is plated in a barrel solution,* 12 *oz. Sodium Stannate,* 3 *oz. Sodium Hydroxide,* 3 *oz. Sodium Acetate,* 125% *using half steel, anodes half tin anodes.*

Ans. This can be caused by the solution being too cold, or using too much caustic.

This meeting proved to be a very interesting one with 65 members present. J. W. HANLON, *Sec.*

TORONTO BRANCH

Another splendid meeting of Toronto members was held Feb. 22nd. The boys are turning out in goodly numbers and it seems like old times. Sec.-Treas. Harry Hand is in the hospital to undergo a rather serious operation and will be unable to resume work for at least two months. The Branch voted that a bouquet of flowers be sent to Mr. Hand each week while he is ill. Two applications were received, two applicants were elected.

Our Annual Euchre Party will be held March 17th, at Hunt's, North Yonge. The committee assures us the affair will excel all previous euchre parties. The feature of the evening was a paper prepared by Mr. Stanley Town, of St. Catharines, Ontario, entitled "Spotting Out". An old subject dealt with in a modern masterly manner. The paper stirred up plenty of discussion and was greatly appreciated by the members. One of our members has trouble with chromium plated articles which are packed for sale in leather cases. Another said spotting out on his goods was found to be a spot in the lacquer, the base metal was perfect. Next month we will have more discussion about "spotting out."

We now hope to have at least one paper for the convention, possibly two.

Martin Robinson performed a feat of magic Feb. 22nd. He will be awarded a medal. Martin corraled and lassoed Charley Meun and brought him to the meeting and Charley actually wrote a request for reinstatement, but there was a hitch subsequently. Charley says "next month". "Believe it or not."

Mr. H. W. Graham, 62 Day Ave., Toronto, Ontario, will act as Sec.-Treas. while Mr. Hand is ill.

E. C. Hiller of Sarnia was in the city just prior to our meeting and we are sorry that business prevented him meeting with us. Come down again, E. C., and attend a meeting.

W. E. BARROWS.

ANDERSON BRANCH

Anderson Branch held a dinner meeting Monday, Feb. 22nd, at the Y.M.C.A. This marked the resumption of branch activities since the strike tied up the local industries employing the majority of our membership. We were all glad to get back to normalcy and there were thirty members and guests present.

After dinner, President Minton introduced the speaker, Mr. Edgar Mueller, vice-president of the Becker Varnish Company of Cincinnati. Mr. Mueller gave one of the most interesting talks the branch has heard recently dealing with enamels and lacquers. He explained in detail the manufacture and composition of enamel, lacquer, and paint and explained various types of coatings. He also stressed the importance of proper preparation of base surface for enameling. His talk was illustrated by several sample panels with-various coatings at different oven temperatures.

Since the subject is akin to our own business, that is, a protective and decorative coating for a base metal, the boys plied Mr. Mueller for two hours with questions and the resultant discussions and explanations were of vast interest. Anderson Branch heartily recommends Mr. Mueller as an interesting and educational speaker.

Meeting adjourned at 9:45 p.m.

LUCIEN R. HINSCH, *Sec.*

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NEWARK BRANCH

The regular meeting of the Newark Branch A.E.S. was held on Friday evening, Feb. 5, 1937, at the Krueger Club, Belmont and Springfield Ave., Newark, N. J. President Samuel Taylor called the meeting to order at 8:30 p.m. The following officers were present: Samuel Taylor, president; George Wagner, secretary; Nelson Sievering, treasurer; and Paul Oldam, librarian. The minutes of the previous meeting were read and approved.

A communication from Mr. E. Steen Thompson, President of the Supreme Society, was read and discussed, and the secretary was instructed to write again to Mr. Thompson asking permission to make the '39 convention international, if Newark Branch should succeed in gaining their objective.

Nathan Sorenson and Jack Shamis were balloted on and elected to active membership. Mr. Paul Oldam, our librarian asked the members once again to work on their exhibits for the New York Convention.

Mr. Horace Smith asked what the difference was between synthetic and gum lacquers. This question caused quite a discussion and it was brought out that synthetic lacquers were far superior to gum lacquers in every respect.

Mr. Robert Sinclair who has just returned from a three months trip to England, was called upon for a few remarks and he told us some amusing stories about the trip. Mr. Oliver Sizelove was given a vote of applause for the good work he has done so far in securing new members and bringing some of the old members back to our fold. Meeting adjourned at 10.30 p.m.

The fregular meeting of the Newark Branch A.E.S. was held on February 19 at the Krueger Club, Belmont and Springfield Ave., Newark, N. J. The meeting was called to order at 8:30 p.m. by president Samuel Taylor. All officers were present. The regular routine business was dispensed with and the meeting was turned over to our librarian, Mr. Paul Oldam, who presented Dr. Blum, of the Bureau of Standards, as the speaker for the evening.

Dr. Blum gave a very interesting talk on different methods of measuring electro-plated coatings. This talk was illustrated by stereopticon views. After his talk, Dr. Blum was bombarded with questions which he was glad to answer to everyone's satisfaction. Dr. Blum was given a hearty vote of applause for his talk by 68 members and visitors present.

We were honored by a visit from the New York Branch who sent a delegation of sixteen members, including the president and secretary, and I am sure they spent a very enjoyable evening with us.

The meeting adjourned at 11 p.m. Refreshments and entertainment followed which lasted until about 2 a.m.

GEORGE WAGNER, *Sec.*

GRAND RAPIDS BRANCH

Grand Rapids Branch held its regular monthly meeting February 11, at the Y. M. C. A., and it was well attended.

Most of the evening was spent in discussing and planning our open dinner meeting to be held at Rome Hotel with Mr. W. M. Phillips of General Motors Corp. as guest speaker. Dinner will be served at 6:30, and will be $1.25 per plate, and we hope to see many new faces and be able to interest them in Branch membership.

CHAS. S. WHALLEY, *Sec.*

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ROCHESTER BRANCH

The Rochester Branch held its regular monthly meeting on Friday night, February 19, in conjunction with its Annual Fish Fry at the Rochester Leiderkranz. The meeting was very well attended and a really splendid fish dinner was enjoyed by all. After the meal Chairman Frank Kolb introduced Dr. Webb, the new research chemist at Bausch & Lomb Optical Co., who favored us with a few words. He was followed by Mr. William Chase of the Agate Lacquer Co., who answered a host of questions for the members. The regular business was then transacted during which the committee in charge of the Bowling Party was dismissed and given a rising vote of thanks. Thanks were also extended to the Fish Fry Committee for a swell repast. The application of Mr. Elmer Nill of the Hickok Mfg. Co. was received and read, and ordered published. The meeting was then turned over to the educational chairman, Mr. Honnecker, who conducted a short educational session after which everyone adjourned to the next room where refreshments were served, the party breaking up in the wee small hours of the morning.

JUDSON R. ELSTER, *Sec.*

PHILADELPHIA BRANCH

Philadelphia Branch held its regular meeting February 19, at 8:00 p.m., President Al. Hirsch presiding. Minutes of previous meeting read and approved. Roll-call of officers was read, one was absent. Application of Mr. Walter Samuel Gross as an Associate Member was acted on. Motion was made that same be referred to the Board of Managers. Carried. Application of Mr. Frank Harper as an active member approved by Board of Managers. Voted on motion that same be received and that Mr. Frank Harper be elected an active member of Philadelphia Branch. Carried.

Communication from Baltimore-Washington Branch read. Motion that same be referred to the librarian. Carried. Communication from Boston Branch read. Motion same be placed on file and as many members as can to attend Boston Branch's meeting Saturday afternoon and evening, Mar. 6, 1936. Carried.

Meeting then was turned over to Mr. Nelson as chairman of the Educacational Committee for the purpose of gathering the data for the Branch's paper to be presented at The Silver Jubliee Convention of the Supreme Society in June, 1937.

Mr. Joe Underwood, our vice-president, gave a very interesting talk on plating which every one received, some very good points on barrel plating were presented.

Philadelphia Branch will be well represented at the Convention as there will be three papers from this Branch. Now Mr. Nelson would like all the members to attend the March 19th and the April 16th meetings so as to enable him to have this data in shape for the Convention.

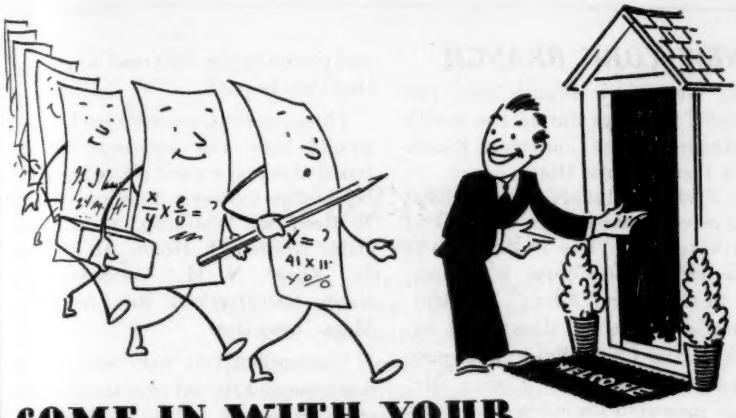
The January and February meetings were well attended which shows the subject is one that is both timely and very useful to the members.

Remember March meeting, Friday March, 19, 1937, 8:00 p.m.

There were 32 members present at the February meeting.

There being no further business the meeting adjourned until March 19, 1937, 8:00 p.m.

ROBERT E. JACKSON, *Sec.*



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NEW YORK BRANCH

The New York Branch held two scheduled meetings during the month of February, at the Conference Rooms in the Pennsylvania Hotel.

On Friday, February 12, an educational meeting, the Branch was favored by a lecture on "The Properties and Characteristics of Copper & Copper, Tin, Lead & Zinc Alloys" by Benj. H. McGar, assistant director of research of the Chase Brass & Copper Company of Waterbury, Conn. Mr. McGar presented his subject well and held the interest of a well attended meeting, afterward answering many questions from the membership present. Mr. McGar was accorded a rising vote of thanks for his splendid paper. There were four applicants elected to membership at this meeting.

On Friday, February 26, the Branch held its regular business meeting. Various matters of import to the Branch were taken up and discussed. Mr. W.J.R. Kennedy of Springfield, Mass., the executive secretary of the Society, was present at this meeting to discuss with the N. Y. Convention Committee the publicising of the aims and objects of the A.E.S. for the coming Silver Jubilee at New York in June. A communication from the Chicago Branch declaring their intention of submitting two proposals to amend the Constitution at the coming Convention was received and read to the membership for consideration. The meeting was adjourned at 11.30 P. M.

F. J. MacStoker, *Sec'y*

BOSTON BRANCH

Boston Branch met Thursday, Feb. 25th at the Manger Hotel with Pres. Mintie in the chair.

Minutes of the previous meeting read and approved, communications read and placed on file, bills read and moved that they be paid.

Three applications were read for the second time and approved by the board of managers and elected to membership as follows: Edmund Jevelli, 70 Reed St., Winthrop, Mass., Associate; Norman J. Houle, 31 Sullavan St., Keene, N. H., Associate; John Greig, 100 Overlook Rd., Arlington, Mass., Associate.

Two applications were read for the first time and turned over to the board of managers as follows: Walter G. Bullard, 5 Rose Ave., Marblehead, Mass., Associate and Leland G. DeLong, 113 Otis St., E. Cambridge, Mass., Associate.

The Banquet committee made its report and they say that it will be the largest affair ever held in New England. Plans are complete and every one attending will have the finest time they ever had. A very fine time is planned for the ladies for the afternoon while the men are attending the Educational session.

Bert W. Sage says that the Educational session is the best one that any branch has had. He has done a great job.

The chemistry is going along fine and Charley Hardy has done a fine job — right on the job every Saturday. He says that the class will have something when the class ends as Dr. William Cahill is doing a great job.

After the regular order of business, Mr. Buckley had as the speaker of the evening one of the past Presidents, Donald Wood and his subject was "Bright Plating." He explained how bright plating is done and how it is cleaned and given a heavy bright silver plate. He had some samples with him and they were very fine — the best we have seen for some time.

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And he had plenty of questions to answer for about one hour and they came fast and he answered them all. A vote of thanks was given Don, for his very interesting talk.

Meeting adjourned at 10.30 P. M.

A. W. GARRETT, *Sec'y*

GOOD WORK, ST. LOUIS

Secretary C. T. McGinley of St. Louis Branch told Ed Musick to tell us to tell you that their Branch is presenting the names of 10 applicants for membership, six active, fours associate and in addition have had four reinstatements during the past month; nice work, boys!

How do you like that, Ted Eichstaedt?

St. Louis Branch will hold a smoker and educational session in April and expects to add more names to the membership list. Mr. Musick is chairman of the membership committee.

Bob Leather is still hunting up more convention pictures of A. E. S. Conventions previous to 1930. How about a little cooperation so that we may have a real display at the New York Convention? Phil Uhl of Philadelphia Branch, and all others, please take notice. Write to R. S. Leather, Lea Mfg. Co., Waterbury, Conn. Bob is so anxious to get these pictures that he will even pay for the postage.

The Third Annual Educational Session and Banquet of Boston Branch at the Hotel Bradford

President Arthur Mintie of Boston Branch opened the third annual educational session on Saturday, March 6, 1937, by welcoming the three hundred and fifty men and two ladies who turned out for the occasion regardless of the stormy weather.

After the usual formalities Mr. Bert Sage was introduced by the President, and was asked to preside at the meeting.

Mr. W. E. Bancroft of the Pratt & Whitney Co., Hartford, was the first speaker, his subject being "Hard Chromium Plating." Mr. Bancroft gave a detailed account of the work done at his plant on tools, rolls, gauges, etc., the solution used and the racking methods employed in throwing the plate into recesses and exposed surfaces; also the stop-off devices employed where only certain portions of an article are plated. The address was well illustrated and samples of the work were shown. A short discussion followed the speakers remarks at the conclusion of which Mr. Bancroft was given a hearty vote of thanks.

The next speaker, Mr. Ben McGar of the Chase Brass Co. Research Dept., took for his subject "New Developments in Copper Alloys." He told of the various alloys being used in refrigeration and other manufactured articles and the development of copper alloys through research up to the present time. Pictures showing stresses and strains and some of their causes were very interesting and created considerable discussion after the reading of the paper. Mr. McGar also received a good hand from the audience as he concluded his remarks.

"The Actual X-Ray of Plating Solutions" by Mr. W. M. Phillips of General Motors, and chairman of our Research Committee, was the feature of the session. To be fully understood, the pictures must be seen, and Mr. Phillips has a way all his own of making it interesting and instructive. Solutions of nickel copper chromium and tin are actually reproduced on the screen, so that one can see the effect of addition agents as they are mixed into solution on the anode and cathode. A silver solution sent in by Dan Wood of Boston Branch was tried out and pronounced very efficient by the speaker. Temperatures and current densities play a large part in the action of the solutions especially in low pH nickel solutions.

The novelty of the picture and its realism made a big hit with the platers. Mr. Phillips was given great applause for his contribution to the success of the session.

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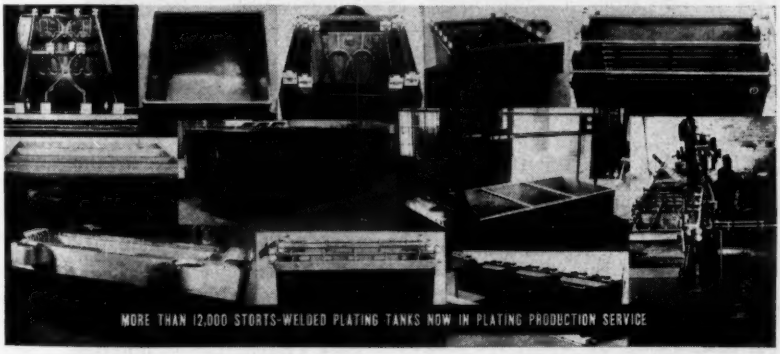

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The Banquet and Floor Show

Four hundred and ninety-one persons sat down to the banquet. There was plenty to eat and everyone seemed to be happy. The only thing we missed was the songfest which is usually a part of the meal and helps digestion. The songs came later however and were sung by the entire gathering.

The floor show was excellent and devoid of any objectionable features. Every act was well received and several times the persons performing were called back for more. No expense was spared in securing the best talent obtainable. The committee is to be congratulated for the type of entertainment and the splendid orchestra under the direction of Winn Davison.

Briefs

Boy, what a crowd! With the exception of the Bridgeport Convention, it was the biggest thing we have seen in New England for years. Boston Branch deserves everything nice that was said about the whole affair. Our hats are off to President Mintie, Bert Sage, Andrew Garrett, Louis Gale, Joe Barrow, Harry Lock, Charlie Campbell, Ed DeLorme, and all the other committee members whose names we would like to mention if we had the space.

The Ladies were well taken care of in the afternoon by the Reception Committee under the direction of Miss Anne Baker, chairlady. Moving pictures and tea kept the ladies interested while the men were "in conference."

President E. Steen Thompson sent his best wishes by wire. We missed you, Eric.

Every Branch in New England was well represented, including the new New Haven Branch, Newark and New York.

Izzy Baker of M. E. Baker Co. cabled his kindest regards from somewhere on the high seas as he headed for South America.

Joe Barrow sure picked up a lot of advertising for the program. Keep it up, Joe; we can still use more in the REVIEW.

The prizes were fine, only there were not enough to go around; we all wanted one.

Boston would like to have the convention in 1938. A large sign on the platform conveyed this information. The members also expressed their feelings on the subject very frankly.

Where next: Newark's annual affair April 10; Bridgeport May 1st; then the Convention in June.

ST. LOUIS BRANCH

The regular meeting of St. Louis Branch was held Friday, March 5, 1937.

Dinner was served at the Central Y. M. C. A. at 6:15 p.m. After that, the meeting was called to order by President Menninges.

Roll Call of Officers showed one absent, Mr. Barth, who is sick; we hope he gets well soon.

Minutes of the previous meeting were read and approved.

Under the head of Applications Received, our hard working chairman on the drive for members opened up with a *bang*. He brought in 10 applications and 4 reinstatements, making a total of 14. The 10 applications were turned over to the Board of Managers to be acted on at an early date, and we will call an extra meeting to pass on same.

Letters were read from Lea Mfg. Co. and Mr. Borrows, and the New York Convention Committee, asking for papers to be read at the Convention. They will hear from St. Louis Branch soon.

Mr. Musick stated that he would have everything ready for our next meeting, which will be a smoker and open meeting.

Mr. J. Vogt and Mr. Menninges are to take care of the Educational programme, date to be announced later, also the place.

We are THANKING

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• •

LASALCO, Inc.

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Mr. Rees Ricket, Mr. J. Humbrecht Mr. A. Riefling, Mr. C. Rieber were the ones reinstated.

Mr. E. J. Musick was given a vote of thanks for his work in bringing in the 14 members and you know it is hard work.

C. T. McGINLEY, *Sec.*

PROVIDENCE-ATTLEBORO BRANCH

The Providence-Attleboro Branch held its regular meeting, Friday, March 19, 1937, at 59 Chestnut St.

The President, Mr. Chace, was scheduled to talk on, "Deposition on Non-Metallics."

Business was deferred and Charlie took the Chair. Unwrapping a variety of samples, he began by passing them to the audience — a baby shoe, an ebony gavel handle, wooden pen-handles, celluloid comb, crucifixes, pieces of composition made from old dictaphone records, etc. Each had a heavy deposit, smooth and nice.

Charlie explained in detail the treatment required for each kind of material. Once or twice he seemed to get stalled and said, "I wish you would ask me some questions so that I will know what you are interested in." Some one would ask a question and Charlie would get another start and on until eleven-fifteen when the Secretary tried to call an adjournment, but did not succeed until nearly twelve.

We were pleased to have Dr. Strachan present.

There were 21 present.

JOHN ANDREWS, *Sec'y*

BALTIMORE WASHINGTON BRANCH

The Annual Banquet and Educational Session of our Branch was held Saturday, February 13, 1937, at the Rennart Hotel, Baltimore, Maryland. We were signally honored on this occasion by having the members of the Executive Board of the Supreme Society present. President Thompson called a special meeting of the board at 10 a.m., previous to our Educational Session. Our members and guests gave their undivided attention and were greatly impressed by the remarks and progressive ideas that were advanced by members of the board when they were called upon by the chairman of our Educational Session.

The following papers which proved very interesting and of technical and practical value were read and discussed.

"New Magnetic Method for Testing the Thickness of Nickel Deposits on Non-Ferrous Metals", Abner Brenner.

"The Use of Color Photography in Connection with Exposure Tests", C. A. Vincent-Daviss and W. Blum.

"Anodic Coating of Aluminum and Magnesium Alloys." R. W. Buzzard.

Due to illness, Mr. Buzzard was unable to present his paper. Mr. J. H. Wilson who is associated with Mr. Buzzard substituted, and handled the paper and discussion in a most capable manner.

The entertainment and banquet was all that could be desired and our committee was congratulated several times during the evening.

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NEW PRIMER PERMITS COLOR-FINISHING OF CHROMIUM

Chromium is notably difficult to lacquer or enamel; in fact, no known type of air-drying lacquer will adhere to it satisfactorily. By the use of a new primer, recently developed by Maas and Waldstein Co., lacquer and enamel manufacturers, Newark, New Jersey, chromium can be finished in any desired color.

The new product, known as "Chroprime", is a clear primer which can be applied to the metal surface by spraying or dipping, after which it is baked. It adheres tenaciously to the metal and provides an excellent foundation for any kind of lacquer enamel. It resists heat, remains flexible, and permits the metal to be engraved after it is applied. It is at present finding extensive application in the production of automobile name-plates and for other purposes where colors are wanted on a corrosion-proof base. Chroprime can also be used as a durable undercoat for finishing other metals.

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A steel panel, coated with an oil that is not removable by any alkaline washing procedure, was half immersed for one minute in a Magnus Emulsion Degreasing liquid at room temperature. It was then given a cold water spray rinse and dried.

This method quickly and thoroughly removed not only oil, but black smut, leaving the metal *clear* and *bright*. This is most important particularly in bright plating.

Magnus Emulsion Degreasing Method has given excellent results on cleaning the interiors of deep drawn work, tubes, before bright plating and before bonderizing.

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Membership Report

To February 18, 1937

ELECTIONS

Harry Unke, 1541 So. 72nd St., West Allis, Wis.
Active, Milwaukee Branch

Kenneth Kusterer, Acme Shear Co., Bridgeport, Conn.
Associate, Bridgeport Branch

Albert K. Schneider, General Electric Co., 1198 Barnum Ave., Bridgeport, Conn. Associate, Bridgeport Branch

Axel V. Boggild, General Electric Co., Box 63, Trumbull, Conn.
Associate, Bridgeport Branch

Dr. Leonard B. Pfeil, Research Director of The Mond Nickel Co., Birmingham, England Associate, Springfield Branch

Luke D. Mosher, The Mosher Co., P. O. Box 23, Highland Station; Springfield, Mass. Associate Springfield Branch

Adalor Granger, Indian Motocycle Co., 132 Malden St., Springfield, Mass. Active, Springfield Branch

Louis J. Jenner, 33 Highland St., Springfield, Mass.
Active, Springfield Branch

William H. Curtis, Millers Falls Co., 8 Gunn St., Millers Falls, Mass. Active, Springfield Branch

Frank Harper, 100 Wandever Ave., Wilmington, Del.
Active, Philadelphia Branch

J. A. Byers, 224 Wallace Ave., Toronto, Ont., Canada.
Associate, Toronto Branch

L. Fairhurst, 425 Lumsden Ave., Toronto, Ont., Canada.
Active, Toronto Branch

H. C. Banin, 14 New Britain Ave., Plainville, Conn.
Active, Hartford Branch

Edmund Jevelli, 70 Reed St., Winthrop, Mass.
Associate, Boston Branch

Norman J. Houle, 31 Sullavan St., Keene, N. H.
Associate, Boston Branch

John Greig, 100 Overlook Rd., Arlington, Mass.
Associate, Boston Branch

Theodore Frank, 902 - 42nd St., Brooklyn, N. Y.
Active, New York Branch

Martin J. Fannon, 119-44 — 177th Place, St. Albans, N. Y.
Active, New York Branch

Alexander N. Braun, 11-13 — 43rd Road, Long Island City, N.Y.
Associate, New York Branch

Morris Israelson, 55 Fountain Place, New Rochelle, N. Y.
Active, New York Branch

A NEW FLEXIBLE FINISH FOR HIGH-GRADE METAL PRODUCTS subjected to extremely hard usage, such as golf sticks and fishing rods, has been developed by Maas & Waldstein, makers of industrial finishes, Newark, N. J.

In gloss and wearing qualities, the new finish, which is known as "Duflex", closely resembles the finish produced by extruding or cementing celluloid upon a metal base, according to the manufacturer. The cost, however, is lower.

In finishing a product, such as the metal shaft for a golf club, by the Duflex process, the product is first covered with a primer coat of synpex enamel, which air-dries rapidly and does not require baking before graining. The grain is then applied in the usual manner, (if wanted) and both coats are baked. After baking, the product is given five dip-coats of clear Duflex lacquer. The resulting finish, the manufacturer states, has a deep gloss and is very flexible and durable. Any metal can be finished by this process.

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Associate, Toledo Branch

William Ehmann, 1845 Champlain St., Toledo, O.
Active, Toledo Branch

S. E. Shank, 355 Morris St., Toledo, O.
Associate, Toledo Branch

Herbert R. Willis, 5405 Edgewater Drive, Toledo, O.
Active, Toledo Branch

Louis C. Andrews, 39 Hamilton St., New Britain, Conn.
Active, Hartford Branch

Carl G. Bondeson, 152 Main St., Terryville, Conn.
Associate, Hartford Branch

Reginald E. Gordon, 2225 Addington Ave., N. D. de G., Montreal, Canada
Active, Montreal Branch

Edward B. Breighton, 706 Read Bldg., Montreal, Canada
Associate, Montreal Branch

Arthur W. Jerome, 3246 Fabre St., Montreal, Canada
Active, Montreal Branch

Thomas Raymond Gill, c/o Udylite Co., 1651 E. Grand Blvd., Detroit, Mich.
Associate, Detroit Branch

L. A. Mead, 2055 Ontario Street, Walkerville, Ont.
Active, Detroit Branch

Stanley Edward Dolman, 470 Kitchener Ave., Detroit, Mich.
Active, Detroit Branch

L. J. Meyers, 3628 Logan Ave., Ft. Wayne, Indiana
Active, Detroit Branch

Walter L. Pinner, 14624 Prevost Ave., Detroit, Mich.
Active, Detroit Branch

Charles F. Rippe, 5720 Hartwell St., Dearborn, Mich.
Active, Detroit Branch

Vincent B. Arnold, 12875 E. Outer Drive, Detroit, Mich.
Active, Detroit Branch

H. C. Luechaner, 19 Stockton Ave., Dayton, Ohio
Active, Dayton Branch

William J. Wise, 601 Oxford Ave., Dayton, Ohio
Associate, Dayton Branch

Barrett K. Green, Research Dept., National Cash Register Co., Dayton, Ohio
Associate, Dayton Branch

R. J. Vandwander, R. R. No. 2, New Lebanon, Ohio
Active, Dayton Branch

Lester Stolle, 1232½ Kumber St., Dayton, Ohio
Active, Dayton Branch

Webster Bonham Knight, 3143 Bellevue Ave., Detroit, Mich.
Active, Detroit Branch